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THE KOETTGEN TOWING LOCOMOTIVE.

TOWING BARGES BY ELECTRIC LOCOMOTIVES ON A GERMAN CANAL.—[See page 483.]

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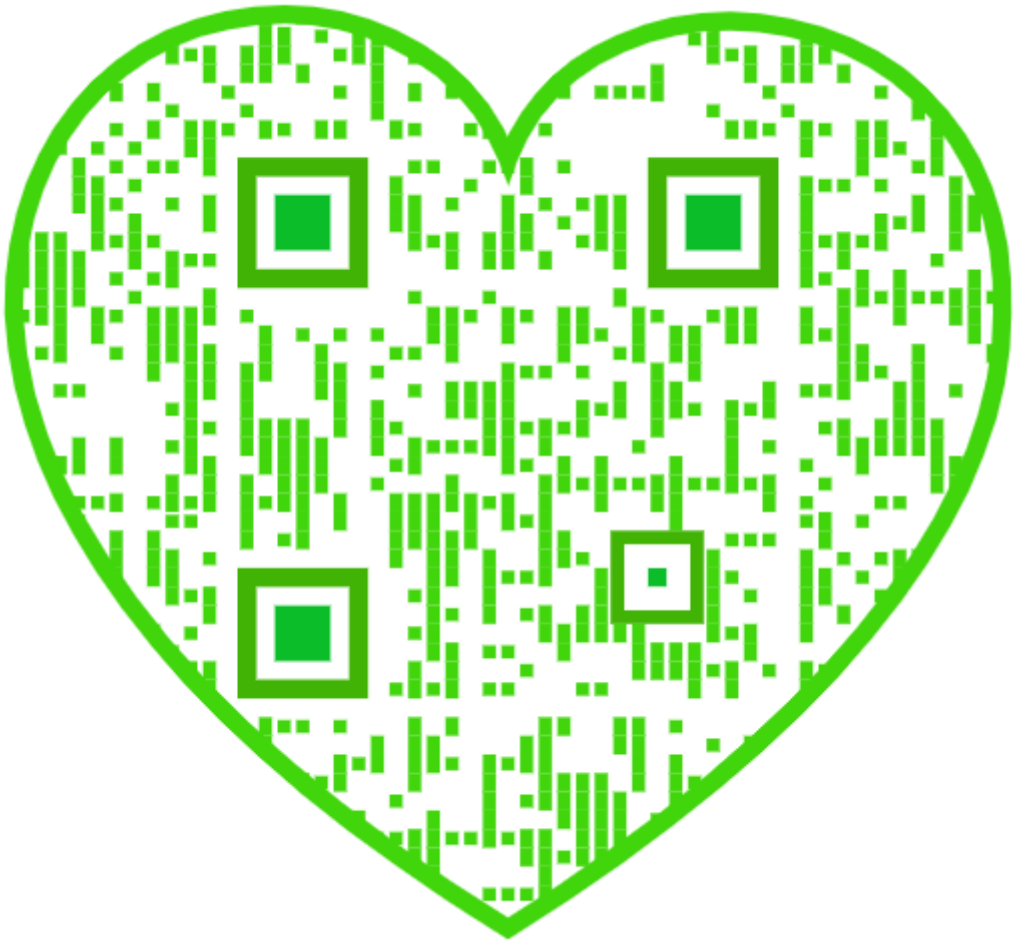

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NEW YORK, SATURDAY, JUNE 27, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE RAILROADS AND THE NEW EAST RIVER BRIDGE.

In a few months' time the East River Bridge will be completed and at the disposal of the traveling public, to meet whose pressing needs this great structure was projected. Like all our public works, it is years behind the time set for its completion, and, therefore, its long-delayed opening would, under ordinary circumstances, be doubly welcome. Unfortunately, however, the question of the utility of the bridge is ultimately dependent upon the co-operation of the street and surface railroads, both in Manhattan and Brooklyn, for whose accommodation the greater part of the space on the bridge has been reserved. No bridge with a floor space approaching that of the new East River Bridge has ever been built, and there is provision for four street railroad tracks and two elevated railroad tracks; this provision being made under the very natural expectation that long before the bridge was completed the various railroad companies would make application to the city for the right to use these tracks at a stated rental. Nothing of the kind, however, has occurred, and to-day the companies are as mute upon this question as though they were unaware that a new East River bridge had been even so much as suggested; or if the matter is mentioned, the railroad companies seem indisposed to make connections across the bridge except at a rental which is purely nominal, and an altogether inadequate return for the great advantages to be derived by the company from this means of interborough connection.

There is a growing conviction among the city officials and the general New York public that the railroads are purposely holding back in the expectation that the city, weary of waiting, and prompted by the urgency for improved communication, will allow the railroads to use the bridge for practically no rental whatever. In view of the large number of valuable franchises that have been practically given away during the past fifty years of the city's life, franchises which to-day should be yielding a princely revenue to the city itself, it goes without saying that a firm stand should be taken in the present case; and we think that the very successful manner in which the city operated its own railroad across the Brooklyn Bridge will fully justify it in laying its own tracks across the bridge and operating them by a system of electric cars run upon the shuttle or the loop system. In the case of the Brooklyn Bridge the city ran the bridge cable roads itself, and was able to show an annual profit on the operation. By laying four tracks across the bridge, the city would be able to put the bridge in full operation on the day on which it is open, and could to that extent be independent of any attempt on the part of the railroad companies to force its hand. It is true that the tracks that are all laid down Delancey Street belong to one of the transportation companies, but there is nothing to prevent the city from laying its own tracks parallel with these upon that portion of the street which is available when the widening of Delancey Street has been accomplished.

PAINTING BY THE ACRE.

Only those who are directly concerned in the operation of a line of steamships have any idea of the enormous total cost of operation of even a single ship, and of the extraordinary variety of the sources from which expense bills are made up. Of course, the main items of expense are perfectly familiar even to the person who takes but a languid interest in a steamship; we all know that the coal bill is a big one, and that on a great passenger steamer the single item of wages runs up to very large figures, while, of course, the bill for provisions and general stores is also a considerable item. Outside of these, however, there are other less-considered sources of expense, one of which, the painting of a ship, is very cleverly treated in an article which we publish in the current issue of the SUPPLEMENT, showing that this single item in the maintenance of the fleet of one corporation runs annually into hundreds of thousands of dollars. So great is the size of a modern transatlantic liner that the total area to be covered every time she is painted runs up into the acres. Thus we learn that to entirely paint the top sides of a big steamship from water line to rail calls for enough paint to cover about an acre of surface. About as much more is required to paint the upper works, while the big smokestacks call for over half an acre of paint, and in the case of the German steamships with four smokestacks, the total area must be nearer three-quarters of an acre. Since the great ships of the first-class companies are painted every voyage, the calculation shows that to keep the one hundred or so vessels of the International Mercantile Marine Company in first-class shape requires the painting of some 2,250 acres each year at a cost of between one-quarter and one-half million of dollars. A curious fact in this connection, which is a direct compliment to our climate on this side of the water, is that on account of the larger number of fine days on the eastern seaboard of the United States, the painting of the vessels is almost invariably done on this side of the water, even in cases where the headquarters of the company are in some English or Continental port.

RAILROAD TIES AND OUR FOREST SUPPLY.

The renewal of wooden railroad ties on the 200,000 miles of railroad track in the United States causes an enormous drain upon the forest resources of this country. The hardwood ties used in the Eastern States of a road with fairly heavy traffic have a life of only a few years, and the softwood fir ties used on the middle, western, and southern roads have a useful life lasting only half as long. When we remember that the average number of ties to each 30-foot rail is sixteen, it is easy to compute that the total number of ties on all the railroads is about 35,000,000, and that if the average life of the tie is five years, there must be needed for renewals about 7,000,000 ties yearly. The average size of the tie is about 6 inches in depth by 8 inches in breadth and 9 feet in length, and consequently in each tie there is about 36 linear feet of timber. Hence the total annual renewals throughout the United States must call for the delivery of over 250,000,000 feet of sawed or hewed timber. Allowing one-third for waste, there must be some 330,000,000 linear feet of timber cut annually from our forests to supply this one item of railroad ties.

In view of these facts particular interest attaches to the statement that the Great Northern Railroad has adopted in place of the ordinary 6x8 tie of rectangular cross section, a tie of triangular section with a face 12 inches in width and a depth to the apex of 7 inches; for in the first place it is evident that there will be a great economy of material in using a tie of a section so much smaller; and it will be seen that there is also an economy due to the use of a tie with a broader face, since a smaller number will be required to the rail. The ordinary 6 x 8 tie has a total cross-sectional area of 48 square inches, whereas the sectional area of the triangular tie is 42 square inches, which in itself means a saving of 4½ linear feet in each tie. One of the most important functions of the tie is to increase the ultimate bearing surface of the track system upon the ballasted roadbed, and, of course, the increase in the width of the tie from 8 to 12 inches means an increase of bearing surface of exactly 50 per cent. Consequently the number of ties per mile may be reduced over one-third without any loss of total bearing surface. Probably no such reduction as this will be made, for the reason that the transverse strength of the triangular tie is not equal to that of the square tie, and the transverse strength has, of course, to be considered. There is a further and incidental advantage in the triangular section, due to the fact that there is a wedging action of the tie when it is under load, tending to make it embed itself more securely in the ballast. In other words, it is to a certain extent self-tamping, adjusting itself in the ballast automatically, and saving a certain amount of oversight and labor on the part of the section gangs. It seems that the new type of tie has passed the experimental stage, since it has been in use in the terminal yards of the Great Northern Railway at St. Paul for several years past, where it is claimed that it has shown itself to be more effective under heavy service than the conventional type. If the same results are shown in main line service under fast and heavy traffic, this very simple expedient will prove to be one of the most radical and beneficial that has been introduced into American railroad practice for many years past.

THE NEW 13,000-TON BATTLESHIPS.

The plans of the two new 13,000-ton battleships, the "Idaho" and "Mississippi," recently authorized by Congress, which have been approved by the Secretary of the Navy, call for two very powerful but relatively slow vessels, the trial speed being placed at from 16½ to 17 knots. This is several knots slower than the battleship speed adopted for some of the newest warships building for other navies, a disparity of which we shall have something further to say later on. The sacrifice of speed has enabled the Naval Board of Construction to give these battleships armor and armament but slightly inferior to that of the big 16,000-ton "Connecticut" and "Louisiana." They will carry four 12-inch guns, in turrets forward and aft; eight 8-inch guns in four turrets at the corners of the central battery, ten of the new 7-inch guns mounted in broadside within this battery, and twelve 3-inch, six 3-pounders, four 1-pounders, besides ten smaller guns. In order to carry this heavy armament other sacrifices besides those of speed had to be made. Thus the after military mast is dispensed with, and the freeboard aft is reduced by 8 feet, the outboard profile of the vessels corresponding very closely to that of the battleship "Maine." The side armor, moreover, is only 9 inches in thickness and the coal supply is limited. Of course, the adoption of these plans was not arrived at in the Naval Board on Construction without the usual controversy between the Bureau of Steam Engineering and the Bureaus of Ordnance and Construction. Admiral Melville has always been a strong advocate for high speed both in battleships and cruisers, and although this may be attributed in part to the natural desire of any particular Bureau in the Board on Construction to secure as large an allotment of displacement as possible, still we cannot but feel that, judged on the broader grounds of national expediency, it is a mistake in designing such powerful and costly ships to limit their efficiency by a return to the battleship speeds of ten or twelve years ago. We have no doubt that the compromise was considered to be the best possible under the limitations of cost imposed by Congress, and we suggest that the best way out of the difficulty would be for the next Congress to increase the appropriation for these two ships sufficiently to allow of an increase in displacement to admit of engines and boilers capable of giving them a speed of not less than 18 knots an hour. When the appropriation for these vessels was first made, it was proposed to make them conform in design to the "Maine" class so that they would form a part of a homogeneous fleet of five vessels. Now, however, they conform neither to the "Maine" class nor to the "Louisiana" and "Connecticut." By an increase of a knot in the speed, these ships could at once be brought closely up to the standard of the "Louisiana," and with the three 16,000-ton battleships "Minnesota," "Kansas," and "Vermont," contracts for which have just been let, they would form a splendid fleet of seven battleships of practically similar speed and power.

"SHAMROCK III." IN DRYDOCK.

When the underbody of "Shamrock III." was revealed in drydock at the Erie Basin, it was evident that she corresponded very closely with the description furnished by our Glasgow correspondent at the time of her launch. Of course, the view then had of the yacht was obscured considerably by the double pontoons in which she was launched, and it was not until one had an opportunity to look her over in drydock that a just appreciation of the undeniable beauty of the boat could be had.

"Shamrock III." is a marked departure, in some respects, from any challenger that has been sent over from the other side for many years past. We have to go back to "Valkyrie II." to find a midship section that bears any similarity to the easy bilges and full garboards that distinguish "Shamrock III." so sharply from any of her immediate predecessors, and in this respect she is the most "wholesome" yacht of any of the existing challengers and defenders of the 90-foot class. Having said this much, it has to be admitted that all the other characteristic features of the boat are marked by the extremes of beam, draft, and overall length to which designers have been driven in their attempt to carry a maximum amount of sail under a rule which, unfortunately, puts no limit whatever upon sail area—an unfortunate omission, to which more than anything else is to be attributed the absurdly exaggerated proportions of the modern racing 90-footer. The over-all length of "Shamrock" is close to 140 feet, the waterline length slightly under 90 feet; beam about 25 feet, 6 inches—not 22 feet, 6 inches, as reported by a cablegram sent out by the builders of the boat; draft in racing trim 21 feet, and her displacement in the neighborhood of 150 tons. Although her midship section is large, the lines, which have been carried out with the skill that characterizes all the Fife boats, are so sweet and fair that she looks at first glance more like a 70-footer than a boat built up to the full 90-foot limit. The sections throughout are round and fair, free from sudden changes of curve or "humps." "Round as a barrel" is a term that may justly be applied to "Shamrock III." She should show small initial stability—a valuable feature when the wind is light and the sea troubled—while her deep and easy bilges will give her great sail-carrying power when

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she is heeled to her best sailing lines. The boat will be comfortable in a seaway, and she will do her best work over the windward and leeward course. Her deep midship section will be a drawback to the boat in reaching, especially when the higher speeds are attained and wave-making begins, and on this point of sailing "Reliance" will probably have no difficulty in leaving her. To windward, judged purely by their models, "Shamrock III." should be the better boat; but "Reliance" has shown such unexpectedly good windward qualities that it is likely that she will be able to hold her on this point of sailing and possibly pull away from her. Before the wind, under spinnaker, "Shamrock III.," because of her smaller wetted surface, should be the more slippery boat; but, on the other hand, the enormous sail plan of "Reliance" will probably outweigh her greater wetted surface, and pull her down to the leeward mark some minutes ahead of her more handsome sister.

The sail plan of "Shamrock II." was found to be so pre-eminently satisfactory that it has been adopted with very little change in "Shamrock III.," the later boat carrying about a couple of hundred more square feet of sail. The mast is 158 feet in length, and the boom 104 feet, with a base line of 78 feet for the forward triangle. The rig is thus, relatively to "Reliance," narrow for its height and favorable for windward work. The question now is whether the deeper-bodied, rounder, and sweeter boat, with her generous sail plan of 14,400 square feet, can hold her own with a flat-floored, shoal, full-bowed boat carrying fully 1,500 square feet more canvas. It is a clear case of a gamble on the weather, with the odds largely in favor of the overgrown boat. In winds that will allow "Reliance" to carry her sailspread, we think there is not a doubt as to the outcome; but should the wind pipe up to a strength of 20 to 25 knots, we prophesy dire trouble for the scow and a good fighting chance for the smaller boat.

THE HEAVENS IN JULY.

BY HENRY NORRIS RUSSELL, PH.D.

The brightest and most interesting regions in the evening skies of July lie to the eastward of the meridian. The Milky Way, rising obliquely from the north point of the horizon, sweeps round in a vast curve to the eastward of the zenith, and descends toward the south. Along it we find a series of brilliant constellations. Beginning low in the north, we first find Cassiopeia—familiar at all seasons, for in our latitude it never sets. Next above, on a level with the pole star, a few rather inconspicuous stars mark the place of Cepheus.

Though this group hardly adds much to the brightness of the sky, the next one makes up for its deficiency, for it is the splendid constellation Cygnus. This is one of the few groups of stars that bear any resemblance to the objects for which they are named. It takes but little imagination to see the head and body of a flying swan in the line of stars that lies almost centrally in the Milky Way, and its outstretched wings in the equally conspicuous line that crosses it.

The southernmost of the principal stars of the constellation—Beta Cygni—which marks the tail of the swan, is well worth looking at with any telescope, however small. It is one of the finest double stars in the heavens, though a very wide pair, and is an admirable example of contrasted colors, the principal star being orange, and its companion blue. The two stars have a common proper motion in space, and it is not unlikely that they are also in revolution around one another, though the period must be many thousands of years, as the stars have shown very little relative motion in the last century. Their distance from the earth is very great—too great for accurate measurement—so that we can only say that the system must be one of enormous magnitude, so great that the sun, or even Sirius, if set alongside it, would seem small in comparison.

Close to Cygnus, and on the western edge of the Milky Way, is Lyra. The brilliant Vega marks this constellation so conspicuously that it is one of the easiest of all to recognize.

Below Cygnus the Milky Way divides into two branches, which pursue a roughly parallel course as far as the southern horizon. The western branch is comparatively faint, but the eastern one contains the brightest part of the galaxy that we ever see, and is full of intricate patches and knots of brightness, and also of dark holes and pockets, some of a most extraordinary character. One of the most conspicuous is in Cygnus, and looks almost as if a dark streak of cloud obscured the stars.

Not far below Cygnus, in this branch of the Milky Way, lies Altair, a first-magnitude star, and one of our nearer neighbors. There are no very bright stars lower down, though the little inverted "milk dipper" in Sagittarius is a characteristic configuration, but the galaxy itself is here fine enough to reward observation abundantly.

West of Sagittarius, and right on the meridian, Scorpio is in full view, from the three stars which mark his claws and the red Antares in his body down to the recurving end of his upturned tail. It is a pity that we never see this constellation at a greater altitude, clear of the mists of the horizon, for it is one of the finest in the heavens.

There is little of interest east of the Milky Way. Pegasus is just rising below Cygnus, and Capricornus is partly visible below Altair.

The planet Saturn, which is about an hour high in the southeast, is the brightest object in that part of the sky.

On the meridian are Draco, above the pole, Hercules, almost overhead, and Ophiuchus, stretching southward toward Scorpio. Virgo and Boötes are farther west, and their principal stars, Spica and Arcturus, are the chief adornments of the western sky. Mars is near the former, but is not very conspicuous.

Leo, which is just setting, and Ursa Major, which fills the space to the left of the pole, complete the list of the constellations now prominent.

THE PLANETS.

Mercury is morning star until the 25th, when he passes through superior conjunction, behind the sun, and becomes an evening star.

He is rather higher than usual and easily seen during the first ten days of the month. On the 1st he is in Taurus, not far from Aldebaran, and rises at about 3:30 A. M., an hour before the sun.

Venus is evening star and is very conspicuous. On the 9th she reaches her greatest eastern elongation, being 45½ deg. from the sun. As she is moving southward, however, she does not remain in sight quite as late as she did in June. On the 1st she sets at 10 P. M., but on the 31st at about 9 P. M. She is moving eastward through Leo and Virgo during the month, and passes close to Regulus on the 16th—within a degree of him. Her phase changes from a half moon to a pronounced crescent during the month, but her decreasing distance, and increasing apparent diameter, more than make good the deficiency, so that she is growing brighter.

Mars is evening star in Virgo. On the 6th he is in quadrature with the sun, and comes to the meridian at 6 o'clock. He is rapidly receding from the earth, and is only one-quarter as bright as he was at opposition in March. As he moves eastward through Virgo he passes quite near Spica, their least distance, 1½ deg., being reached on the 23d.

Jupiter is in Aquarius and rises about 10 P. M. on the 15th. He is the most conspicuous object in the morning sky, but it is still too early to observe him comfortably in the evening.

Those who can command good telescopic aid, and who are interested in watching his satellites, will be repaid for the trouble of looking at him on the nights of the 22d and 29th, for on both these occasions the planet appears for some time with only one visible satellite—the fourth. On both nights the first satellite is in transit in front of the planet, and the second and third are behind it, or eclipsed in its shadow. The succession of phenomena—ingress of one satellite, egress of another, occultation of a third, etc., occupies the whole night, but the most interesting hours of observation are from 11 to 1 in both cases.

Saturn is in Capricornus, and comes to opposition on the 30th. He is still very far south, but is a little better placed than last year. In spite of his low altitude he is a most interesting telescopic object. The smallest instrument will show his rings, and his brightest satellite, Titan, whose motion round the planet, completed in a period of 16 days, is interesting to watch. A larger instrument brings out the smaller satellites nearer the planet, as well as the outer one, Iapetus, which is about three times as far away as Titan, and takes 80 days to complete its circuit.

Uranus is in Ophiuchus, and comes to the meridian at 10 P. M. on the 15th. Neptune is morning star in Gemini—too near the sun to be observed.

THE MOON.

First quarter occurs at 4 P. M. on the 1st, full moon at 1 P. M. on the 9th, last quarter at 2 P. M. on the 17th, new moon at 8 A. M. on the 24th, and first quarter once more at 2 A. M. on the 31st. The moon is nearest us on the 24th, and most remote on the 10th.

She is in conjunction with Mars on the evening of the 1st, Uranus on the 7th, Saturn on the 11th, Jupiter on the morning of the 15th, Neptune on the 22d, Mercury on the 24th, Venus on the 27th, and Mars again on the morning of the 30th.

The most noteworthy of these conjunctions are those with Jupiter and Mars, which are quite close, especially the first conjunction with Mars. In fact, an occultation of the planet is visible from the southern parts of the United States on July 1, the hour verging from 8 to 9 P. M. Eastern Standard time, according to the location of the observer. As seen from New York, Mars will only make a close approach to the northern limb of the moon.

Cambridge, England.

SCIENCE NOTES.

The Great Salt Lake of Utah is gradually drying up. Readings taken by United States Section Director Hyatt show that the lake level, despite heavy rains, is 2 feet, 6 inches below the normal.

Before the Chemical Congress at Berlin, on June 7, Prof. W. Markwald exhibited specimens of polonium. A bit of the metal was shown weighing 0.15 of a grain, which was produced from two tons of uranium at a cost of $75.

Andrew Carnegie has purchased the famous zoological collection of Baron de Beyet, of Brussels. The collection is especially rich in specimens of extinct birds of central Europe and northern Asia. The collection is to go to Harvard University.

The temperatures of the stars are given as follows in the Report of the International Congress of Physicists of 1900:

Star.	W.L.	T°	t°
The Sun	0.54	5450	4850
Sirius	0.46	6400	5700
Vega	0.46	6400	5700
Arcturus	1.08	2700	2450
Aldebaran	1.03	2850	2550
Betelgeux	0.94	3150	2800
Electric Light	0.84	3500	3150

W. L. is the known wave length of the wave of maximum energy; T, t are the limits between which the absolute temperature must lie.

In the early history of Virginia and Maryland tobacco was by all odds the most important crop, and it was even possible at times to secure a wife in exchange for a moderate amount of tobacco, as in later days in the West a squaw could be obtained in exchange for a small amount of whisky. In 1732, at Jamestown, tobacco was made a legal tender for all debts, including customs. In about a dozen years after the founding of Jamestown by Capt. John Smith, an English nobleman, Sir Edwin Sandys brought over with a shipload of supplies ninety young English maids, who, immediately upon their arrival, were wooed and married by the colonists, each being paid for at the rate of "120 pounds of good tobacco." As late as 1777 the annual poll-tax of Baltimore city and county was fixed at 172 pounds of tobacco. Tobacco, it is well known, was a native Indian crop in America before the advent of Columbus.

With their little red wrappers decorated with black polka-dots, the various members of the lady-bug family are gay and attractive members of the insect world. They are always man's friend, and get most of their living by preying on the destructive soft-bodied plant lice, the most common of which is the green aphis, which can commonly be found on house plants and rose bushes. The most striking example of the usefulness of the lady-bug to the horticulturists is seen in the case of *Vedalia cardinalis*, the bug which was imported from Australia and which saved the citrus trees of California by destroying the cottony-cushioned scale which was devastating the orange and lemon groves. In the study of the grain aphis it was found that a species of lady-bug preyed upon this pest. The former were observed to go down among the roots of the grain in the field in search of the aphides, and to pass the winter along with them in that situation. The larvæ of the lady-bug also live principally upon insects which are destructive to garden and field crops. The dainty lady-bug should never be destroyed.

In a note in Science Dr. Sidney Reeve presents in a brief form the views respecting the dissipation of energy set forth in his book, "The Thermodynamics of Heat Engines." In discussing the second law of thermodynamics he says: While any given quantity of energy tends, so long as it exists without transformation, to fall in intensity and never the reverse, yet the secondary form of energy into which that quantity may at any time find itself transformed possesses a degree of intensity that is entirely independent of that of the original quantity, and which is the maximum permitted by circumstances. In other words, energy tends downward in intensity during untransformed existence and upward during transformation. This necessarily denies *in toto* the doctrine of the dissipation of energy and affirms, on the contrary, that as much exaltation of energy as depression is constantly going on. In short, the total fund of intensity or availability of the energy of the universe is as constant as is the universe's total fund of mass, or as is its total fund of the product of the two, energy itself. The availability of the energy of the solar system is, of course, being steadily dissipated. But astronomy has long since passed the point where observations confined to the solar system suffice for the establishment of fundamental principles of this sort. The old doctrine of the dissipation of energy necessarily excluded any possibility either of the universe being infinite or eternal in its extent, or of its being one with the solar system. The new statement is not only consistent with such views, but it implies them.

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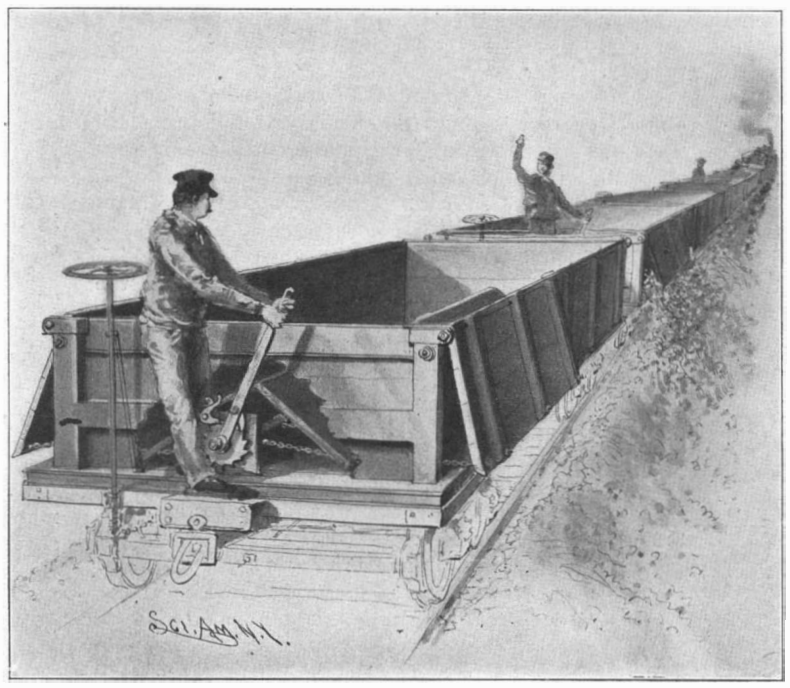
DUMPING-CAR WITH CONVENIENT LOCK AND RELEASE.

An improved device for railroad dumping cars is covered by a patent recently granted to Mr. A. J. Twiggs, of Augusta, Ga. The invention relates particularly to cars having peak-shaped bottoms and side doors which open outwardly to allow the contents of the cars to slide out to the sides of the track. The improvement may be placed on any flat car at moderate cost, and consists in a new locking means which may be readily operated to lock or open these side doors. A winding shaft passes longitudinally through the car below the peak bottom and to this shaft the side doors are connected by chains. The shaft is provided at each end with a ratchet wheel adapted to be engaged by a pawl fulcrumed upon an operating lever which is hung loosely on the winding shaft. The ratchet is locked against return movement by a dog pivoted on the car body. The dog is provided with an upwardly extending tripping arm which is adapted to be engaged by a latch. When operating the ratchet this latch is thrown out of engagement with the tripping arm. The tripping arm is so disposed relative to the ratchet pawl that, with the latch thrown up, when the lever is moved to the left this arm will be engaged by the fulcrum end of a pawl and the dog will be thus swung out of engagement with the ratchet wheel. Further movement of the lever causes the dog to lift the pawl also out of engagement with the ratchet teeth, thus unlocking the shaft. The chains are then free to unwind from the unlocked shaft and the pressure of the load against the side doors of the car causes the doors to swing open. When it is desired to close the doors the lever is swung forward, throwing the pawl into engagement with the ratchet wheel and permitting the dog to fall to its normal position. A short up-and-down motion is now given to the lever which intermittently turns the ratchet wheel, winding up the chains on the shaft and drawing the doors to their closed position. The latch is now thrown into engagement with the tripping arm and the doors are thus securely locked.



IMPROVED LOCKING DEVICE FOR DUMPING-CARS.

GERMAN TESTS OF THE PUPIN SYSTEM OF LONG-DISTANCE TELEPHONY.

In Supplement No. 1308 we gave a thorough explanation of the earlier experiments of Dr. M. I. Pupin, of Columbia University, in long-distance telephony.

A practical demonstration of his theory concerning the action of uniform and non-uniform conductors, together with the effects produced by the non-uniform conductors upon the amplitude of the waves, showing at the same time the limit to which such non-uniform conductors may be used, is also given. Dr. Pupin's investigations were directed mainly toward lessening the electrostatic capacity of cables, aerial, subterranean, or submarine. To do this within the circumscribed limits of a laboratory, it was necessary to construct a line with an ohmic resistance equal to that of a cable of a given length, and this he accomplished by the use of a line of tin foil carefully insulated and folded many times upon itself. When finished, the line possessed a resistance equal to that of 250 miles of cable. This cable, with the means employed to make of it a non-uniform conductor, we also illustrated in the same issue. The theory then, and so much of its application as was possible within the walls of the laboratory, we owe to Dr. Pupin; for a more extended application of the theory we must look to others. We all know that telephone lines over long distances, such as from New York to Philadelphia, Albany, Boston, or Buffalo, are simple, open, free copper wires suspended from ordinary telegraph poles. This method of construction is not followed from purely economical reasons. A line of this length, if formed into a cable of ordinary construction, would not deliver an audible word at the receiver.

Peculiar effects are apparent the moment these wires are insulated and formed into a cable. The so-called electrostatic capacity of the cable operates to damp the telephone currents, and by attenuating the waves prevents them from reaching the terminus.

The greatest difficulty is experienced in sending a message through an ordinary cable 30 miles long. A cable 50 miles long presents insuperable difficulties. Many attempts have been made to reduce the capacity of the cables, such as placing layers of paper between the insulating materials of correlative wires, thereby to hold a film of air about them and thus lessen the effect of the various electric currents passing in such close proximity.

Such experiments have proven in a measure successful, but only for moderate distances; a few miles added to the length renders them ineffective.

By a practical application, however, of Dr. Pupin's discovery, cables five and six times as long as those now in use may be successfully operated.

The damping of the telephone currents depends upon three factors; the resistance of the conductor, the capacity of the cable, and its self-induction. An increase in the first two produces a like increase in the attenuation or damping, while any augmentation of the self-induction diminishes the damping.

Accordingly, we may reduce the attenuating effect of the cable, regardless of its capacity, to any desired point, provided we are able correspondingly to increase the self-induction. The phenomenon of self-induction was known to both Heaviside and Thompson, who even knew that the induction coils should be distributed along the cable; but it remained for Pupin to work out the law according to which the coils were to be placed, and fix their exact position upon the cables, thus furnishing the first practicable and trustworthy application of the system. Pupin discovered that, in order to accomplish the desired result, the coils must be inserted at distances corresponding to a fractional part of the wave length of the alternating current passing along the cable (conductor).

With these data before them, Siemens & Halske, of Berlin, made many experiments in their laboratory which gave most astonishing results. By the permission of the German Imperial Postal Department, this firm proceeded to equip the subterranean telephone cable with Pupin coils, the cables consisting of 28 double copper wires 1 mm. thick each, which connect Berlin with Potsdam over a distance of twenty miles. The insertions of the induction coils took place at the coupling boxes, one case of coils such as we show in Fig. 1, being laid at every other coupling box. In this manner, just half of the 28 double lines were provided with spools. Each case, or metallic box, contained 14 coils, the detailed construction of which is shown in Fig. 1, duly sealed and filled with insulating material such as paraffin. The ends emerging were then joined to the corresponding ends of the main wires inclosed in the sleeve joint, which was likewise poured full of insulating material. The distance between each successive case of coils was 4,265 feet. Measurements showed that, after the connecting in of the spools, the self-induction had increased two hundred fold, while the damping constant had been reduced to one-sixth. A great improvement in the talking efficiency of the line was to be expected, and the results confirmed the expectation.

When one of the loops provided with the Pupin coils was compared with one left without such assistance, the difference in the intensity of sound was astonishing. Standing at a distance of 15 inches from the receiver of an ordinary line, the words could scarcely be distinguished, while the receiver of the Pupin line projected the sound waves with such energy that the words were distinctly audible across the room, 33 feet distant. More startling was the effect of the Pupin system when several of the loops were connected. Three loops formed a continuous line of 60 miles in length. Over this length of unassisted wire the voice of the speaker could hardly be heard, and when five loops were connected, making a line 100 miles long, it gave out altogether, failing to deliver a word at the receiver; whereas the Pupin line delivered the voice with about the same intensity of tone as that received over the single 20-mile wire, thus showing a five-fold increase in the speaking property of the line due to the Pupin coils. Thirteen Pupin loops were now connected,

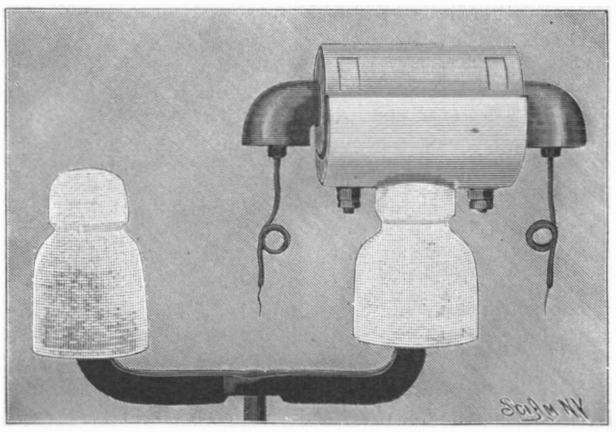


Fig. 2.—INDUCTION COIL FOR AERIAL CONDUCTORS.

making a line 262 miles long, and the speaker could still be heard, though his voice sounded very low. Compared with open wires, it was found that an assisted wire of 1 mm. (0.39 inch) diameter in a cable was equal to an open unassisted wire of the same length but of twice the diameter. Having obtained such favorable results with the cable, the most obstinate

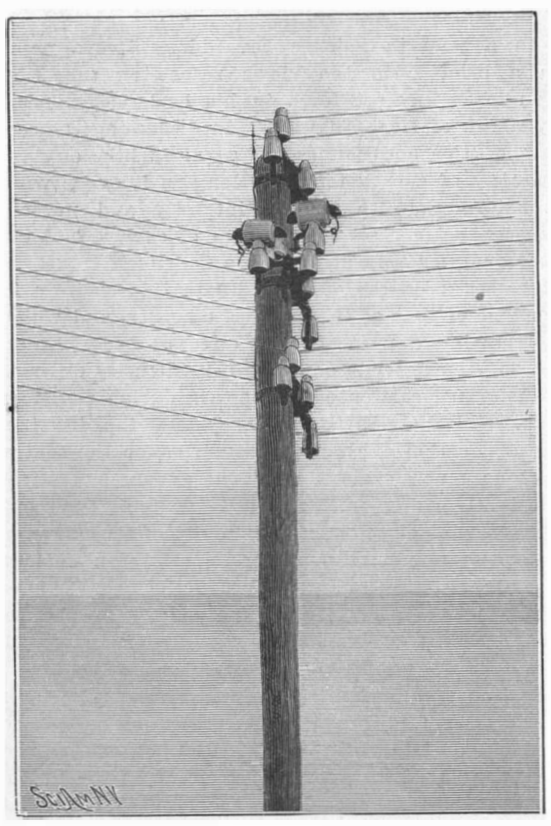


Fig. 3.—AN AERIAL LINE EQUIPPED WITH PUPIN COILS.

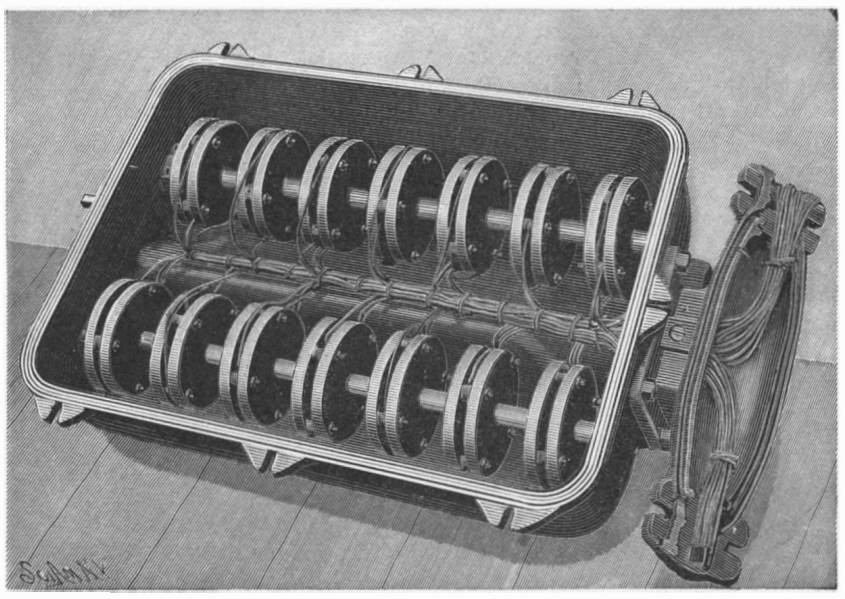


Fig. 1.—THE INDUCTION COIL BOX.

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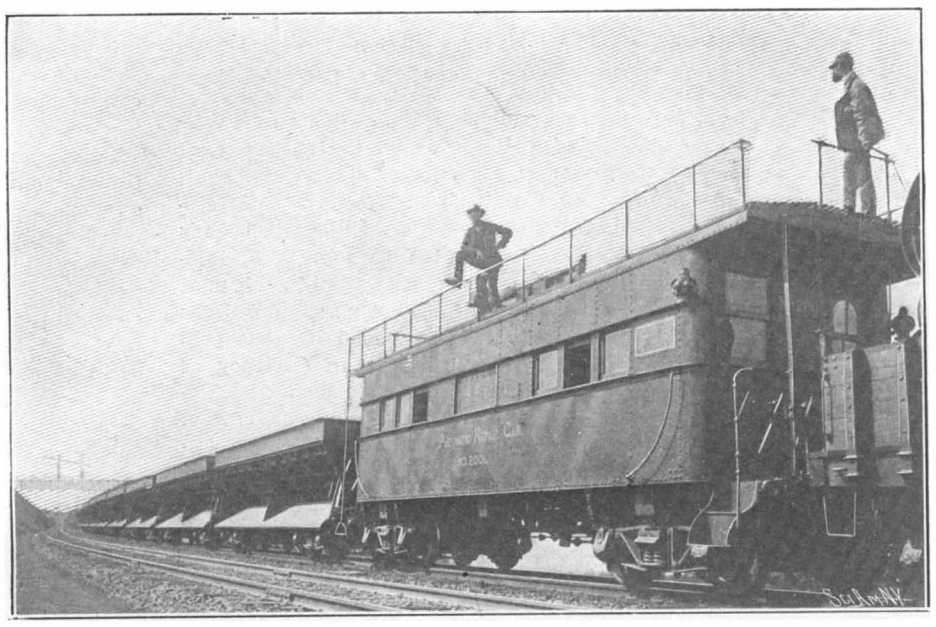
of all electric conductors, attention was turned to the open or uncovered wires. The line running from Berlin to Magdeburg, a distance of 93 miles, was selected. The comparison was made between a wire 2 mm. (.078 inch) in diameter and 93 miles long, and another of 3 mm. (.118 inch) in diameter and 111¾ miles long. Fig 2 shows the manner of equipping the former wire with the coils, as well as the double insulator. The coils were placed upon poles 2½ miles apart, and it was found that the assisted smaller wire far surpassed the work performed by the larger wire. In Fig. 3 we show a pole with a number of coils attached. These results prove that in the Pupin inventions, new means are provided for greatly increasing the speaking property of cables. The day may not be so very far in the future before New York and London, Paris, Berlin, Vienna, or St. Petersburg may be telephonically connected, and "Hello London," will be a common expression in Wall Street. The coils necessary to assist a wire are not too large to be placed in the sheathing of a transatlantic cable. Hence such a cable is by no means an impossibility. Such coils, if placed at proper intervals, may not exceed an inch in length with a diameter of half an inch. With the Marconi wireless telegraphic and the Pupin relay telephonic systems in working order, the era of quick and easy communication will have arrived.

A STEEL CABOOSE AND REPAIR CAR.

BY GEORGE J. JONES.

With steel cars now coming largely into use, entirely new problems of maintenance and repair are encountered. When a wooden car is wrecked in a collision or other accident, the problem generally presented is that of getting the debris out of the way as soon as possible and to subject the following trains to the least possible delay. But in the case of the steel car the damage sustained is of an entirely different character. With the proper facilities at hand, it is necessary only to replace a few parts, to straighten out a few others, and the car is ready to proceed to its destination.

The Goodwin Car Company has been the first to meet these changed conditions by the construction of a combined caboose and repair car, which is designed to accompany trains of the dumping cars built by that company. Such a car is shown in the accompanying cut, and was built for the Carnegie Steel Company as part of a train which that concern is now operating in the vicinity of Pittsburg. One of the features of superiority of this car over the caboose of wood is its great strength. It has but two sills, which are of steel and form the backbone of the car, being situated on the line of the draft and pulling strains. The rigidity thus obtained is especially desirable where it is found necessary to make use of pushing engines on mountain grades. One of the most common forms of accident is the result of the collapse of the caboose in these trying circumstances. The sudden application of the brakes at the head of the train on a slight grade has been known more than once to smash the caboose into splinters, killing or maiming the occupants. The steel caboose has already been put to a test of this character in actual practice, and no fault whatever could be found with its behavior. As a repair shop, this car is fitted with the pneumatic tools which are necessary to remedy any ordinary damage that will be encountered on the road, and which are operated from the train-line pressure of the air-brake system. The car parts are all interchangeable, and the repair car is fitted out with duplicate parts. Where it is necessary, it will be a comparatively easy matter to cut out a broken part and substitute a new one. A special tool is provided on the car for doing this work quickly. By means of this tool the rivets are cut out so that new parts can be substituted. With the usual cold chisel and sledge hammer, it would be impossible to accomplish much in difficult places under the car.



A STEEL CABOOSE AND REPAIR CAR.

The tool in question consists of an ordinary piece of hydraulic piping with a series of cutting teeth on one end, the other end being fitted to the drill ordinarily used with the pneumatic equipment. These teeth being allowed to operate on the head on the rivet, cut it away until it can be driven out with little difficulty.

In the construction of the steel cars, bolts are used instead of rivets on all parts which are most liable to damage while on the road by reason of accident. These parts can then be removed and replaced merely by the use of a monkey wrench, which feature further simplifies the matter of repairs on the road.

The steel caboose also can be used as an observation car, being supplied with a cupola and a railing around the top of the car. From this point the operation of the entire train can be observed. By opening an air-valve at one end of the car, any car or the whole train can be dumped either at the side of the track or in the center. This feature is of great advantage in trestle filling and storage purposes, mineral transportation and for filling work.

The dahlia is a plant prized solely for its bloom, yet were all the Irish potatoes to be destroyed, it is possible that this plant would to some extent replace them. Roasted, the dahlia bulb is wholesome and toothsome and makes a not bad substitute for the potato. When first introduced into Europe, it was not for its flower, but as a vegetable that it was valued. —G. E. M.

ELECTRIC HAULAGE ON CANALS.

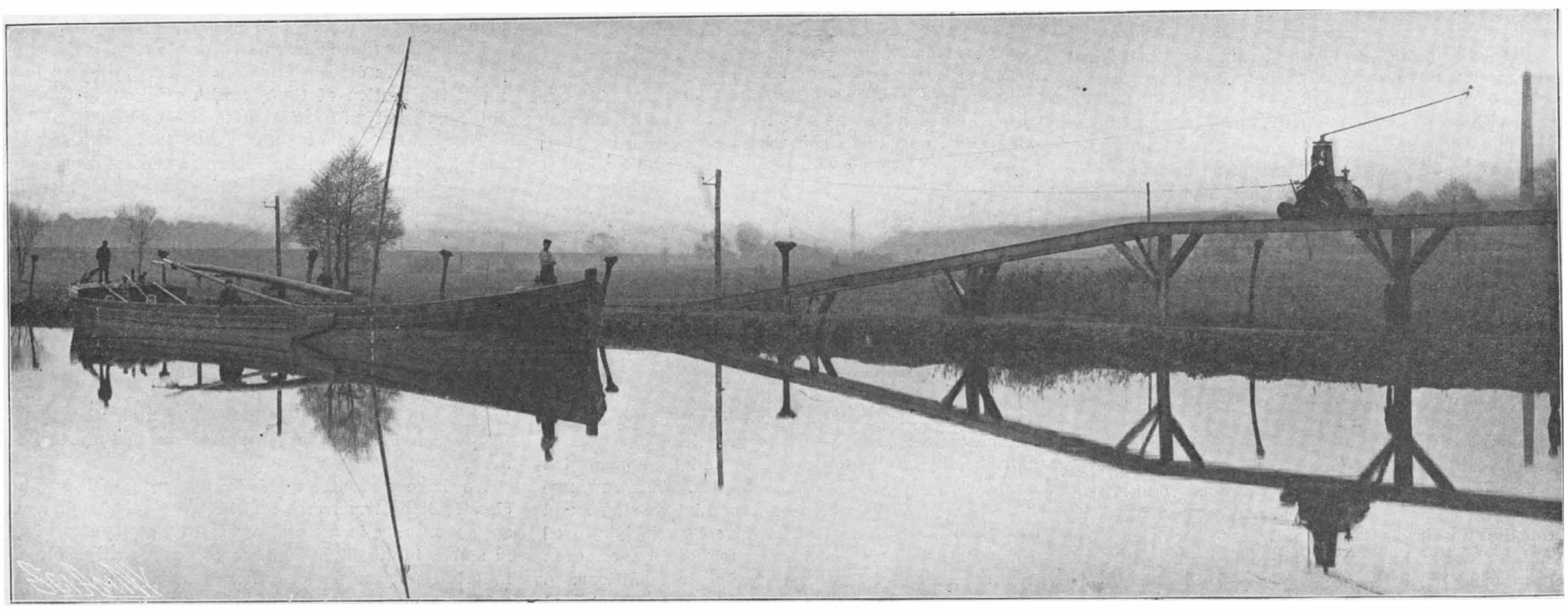
BY FRANK C. PERKINS.

Since the prize competition for an electric canal haulage system to be used on the Teltow Canal, considerable attention has been drawn to what has been done in the same field during the past decade. The Teltow Canal, nearly forty miles in length, it is said, would carry nearly five million tons per annum, connecting as it does the rivers Spree and Havel. The committee in charge of the competition offered prizes of about $3,000 for the best electric system of canal haulage. A score of applicants took part in the competition.

It may be of interest to consider some of the work done in electric canal haulage before going into the details of these tests. In Germany, France, America, and other countries experiments have been made with electric canal haulage systems with varying success during the past ten years or more. Recently it has been seriously questioned whether the railroads would be able to supersede the canals entirely or even compete successfully against them, when electrically equipped, for moderate speed transportation of freight. The general tendency is to enlarge canals to accommodate larger boats. The Erie Canal has been somewhat enlarged and will undoubtedly soon be reconstructed, and equipped for handling immense quantities of freight. The Oder-Spree Canal was enlarged for boats of 450 tons. The Dortmund-Ems Canal boats have a capacity of 750 tons. Large boats are also to be found on the great Mittelland Canal.

Lamb's aerial system was tested in America on the Erie Canal near Buffalo some years ago and on the Finow Canal near Eberswald, Germany. A strong steel cable is used in this system for supporting the motor carriage. The current is received from an overhead trolley wire and travels along the suspended cable. The steel cables are all supported on posts along the bank of the canal. The propelling mechanism consists of a revolving drum which winds itself on and along a second steel cable provided for the purpose. The length of the system installed for this test was somewhat less than half a mile.

The motor used was of about 1 ton weight, 500 volts pressure, and of 5 horse power capacity, while the speed attained was about 13,000 feet per hour, or 3.6 feet per second. On canals of many curves and turns the suspended system of haulage is open to the objection that many supporting posts are required. The weight of the heavy cable is said to be an objection; besides, many engineers contend that the cost of maintenance would be high. One of the advantages claimed for this system is that it leaves the bank free.



TOWING CANALBOATS BY ELECTRIC LOCOMOTIVES (KOETTGEN SYSTEM).

The Koettgen electric canal haulage system employs one rail in some cases and two rails in others where tests have been made as on the Finow Canal. The electrical equipment was supplied by Siemens & Halske of Berlin. The length of track used was about 3,300 feet and an electric locomotive is employed for hauling the canalboats. The single rail is placed farthest from the canal so as to impede other traffic on the canal as little as possible. Two of the locomotive wheels are grooved, are small in diameter, and carry more than three fourths of the weight. These small

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grooved wheels rest upon the rail. A pair of broad tire wheels, spring suspended, are employed on the side toward the canal, rolling along the tow path, on the ground.

This single-rail locomotive has a 15 horse power electric motor operated at 500 volts pressure, the direct current being supplied from an overhead trolley. This hauling locomotive is said to have made a speed of 5½ miles per hour, the normal speed being about 3 miles per hour. The motor weighs about 4,000 pounds. The locomotive is low, an upright carrying the trolley pole as shown in the accompanying illustrations.

Where two rails were used on the Finow Canal test, with the Koettgen electric locomotive haulage system, a one-meter gage was employed, and the two rails were supported on cement blocks in place of the usual ties employed in track construction. During these tests the locomotive was able to haul three loaded barges with a 700,000-pound load at a speed of 3 miles per hour, also two loaded and two empty barges at the same rate of speed. It has been estimated that with a traffic of 10,000,000 tons per year the cost with this electric system would be 0.0029 cent per ton-mile, and with 3,000,000 tons per year, 0.0038 cent per ton-mile, while with steam power under like conditions the cost would be 0.0042 cent and 0.0058 cent respectively.

The English aerial electrical canal haulage system, devised by Thwaite & Cawley, provided a method which would not interfere with the use of horses and was designed to prevent the waste of energy incurred with a screw propeller. The aerial railway provided in this system consists of two steel rails of channel section braced together at one side to form a rigid girder. These were supported about 10 feet above the tow path by cast iron brackets or by wooden posts placed about 30 feet apart. Each of these rails was used for supporting electric locomotives of small size having four wheels. Two of the wheels were operated on the upper surface and two pressed upward against the lower surface, the motive power being supplied by an electric motor geared to the four axles by worm gearing, running in oil. A direct-current series-wound motor was used, the tractive force required for towing a barge of 100 tons at 2½ miles per hour being estimated at 250 to 300 pounds. The small locomotive was controlled from the barge, no operator being required except on the boat. The current required was said to be 15 amperes at 500 volts when starting up to a speed of 4 miles per hour. Mr. A. H. Allen, in reference to this system, gives the following as the cost per ton mile and time occupied in transit with horses and electric power. With horses at 2½ miles per hour and 15 hours as time occupied in transit, 0.077d.; with electric haulage at same rate of speed and 12 hours, 0.032d.; while with electric haulage at 4 miles per hour and time occupied during transit 7½ hours, the cost of same per ton-mile is given as 0.041d. The advantages of the electric haulage system are that the delays in passing are avoided, bridges and tunnels give no difficulty, power can be supplied to private consumers, cost of haulage is reduced, and time of transit as well.

The Galliot system employed on the Burgundy Canal employs an electric tricycle which is operated along the towpath. A 6-kilowatt motor is utilized, which receives the current from a suspended trolley wire, a towrope being used for hauling the barges. The tricycle locomotive weighs 4,000 pounds and tows a number of boats with 700 tons at a speed of 1¼ miles per hour. The power required is stated as follows by Van der Wallen: With a load of 387 tons at the above speed the power utilized is 3.45 kilowatts; with 186 tons, and a speed of 1.37 miles per hour, 1.8 kilowatts; and with the tricycle alone at a speed of 3.75 miles per hour, 0.9 kilowatt.

The Bougie system of chain haulage has also been tried on the Burgundy Canal. A motor is placed upon the barge, which drives a chain haulage gear, and the current is supplied by means of two trolleys and two trolley wires. With this system the cost is said to be 0.67d. per ton as compared to 0.98d. per ton for steam haulage, the distance being somewhat less than four miles, half of which is in tunnel. The system has been fully described in the SCIENTIFIC AMERICAN.

On the Charleroi Canal to Brussels, which is 50 miles in length, the Gerard system is employed. The power house is located at Oisqueroq, 16½ miles from Brussels. The total engine and boiler equipment has a capacity of 450 horse power, three-phase alternators being operated by the engines with cotton belts. The pressure on the line is 6,000 volts, and the high-tension line as well as a secondary three-phase low-tension conductor are carried on poles, the former being 36 feet from the ground and the latter 18 feet. The pressure of the low-pressure line is 600 volts. Substations are located at intervals of three miles along the canal, in which transformers of 36 kilowatts capacity are installed.

The electric locomotive or tractor is of the four-wheel type, and runs along the towpath without the use of rails. It is supplied with a 5-horse power three-phase motor, which will handle a maximum load of 20 horse power when necessary. This locomotive is about 3½ feet wide, a trifle less than 8 feet long, and weighs about 4,000 pounds. A triple trolley is used, and when meeting other boats, the trolleys are exchanged, or the towropes are exchanged and the tractor returns over the same section. Each tractor runs over a section with five barges, each with loads of 20,000 pounds, the speed being 2½ miles per hour. The current is also sold to factories and other consumers along the canal for light and power service.

In reference to the various systems of electric canal traction, Mr. L. Gerard is authority for the following, calculating the efficiency as the ratio of the power actually developed in the towrope to the electrical power applied. (In Science Abstracts, p. 657, 1901, from Soc. Belge Elect. Bull.) "The Koettgen track system on the Finow Canal showed a maximum efficiency of 0.704 when towing a 100-ton barge at 3.75 kilometers per hour; the tractor working up to 20 e. h. p. at most, with an expenditure of 5¾ e. h.p., running light at 7.5 kilometers per hour. The Denefle tricycle (old form) on the Aire and Deule gave an efficiency of 0.414 when towing a barge of 293 tons at 2.8 kilometers per hour, with a maximum power of 9.3 e. h. p. Running light at 3.74 kilometers per hour, the tricycle took 4.17 h. p. A new pattern of the tricycle gave an efficiency of 0.44 with the same load at 2.64 kilometers per hour. The Gerard tractor gave 0.534 at 3.6 kilometers, towing two 70-ton barges, and took 5.5 h. p. at 4.4 kilometers empty. The Gerard screw propeller system gave an efficiency of 0.322 at 3.2 kilometers, the screw making 375 revolutions per minute when towing two 70-ton barges, and took 5.4 h. p. at 8.2 kilometers empty. This result is compared with steam practice, for which a maximum efficiency of 0.294 is given." Gerard maintains that with electric haulage a large increase in the number of voyages may be obtained over animal haulage, and the electrical distribution of power for dredging, pumping, and other power purposes as well as for lighting should not be disregarded in connection with the electrical system.

The results of the Teltow Canal competition are of particular interest, and refer to the first cost and the working cost per ton-kilometer on a canal 37 miles in length and with one and one-half million tons of freight traffic per year as a basis. The first cost of the Siemens & Halske system was two and one-half million marks, and the working cost per ton-kilometer was given as 1.07 pfennigs; and while the first cost of the Feldmann & Zehme system of electric canal haulage was not given, the working cost per ton kilometer was 0.667 pfennig. The Rudolph system of the Kanaltauerei Gesellschaft is given as 2,597,000 marks, and the working cost 0.61 pfennig per ton kilometer; while the system having the lowest first cost as well as the lowest working cost was that of Ganz & Co., of Budapest, Austria-Hungary. The working cost was 0.43 pfennig per ton-kilometer, and the total first cost only about seven thousand marks over one million marks, or less than half of the first cost of the other systems above mentioned.

The Kite Principle in Aerial Navigation.

BY GARRETT P. SERVISS, JR.

When the problem of aerial navigation, with machines heavier than the air, and supported by mechanical means, was finally put upon a firm scientific basis by the experiments of Tatin, Langley, and others, it became evident that man was physically incapable of supporting himself in the air by his own exertions.

Attention was then directed toward the perfection of light motive powers, until at the present day, thanks to the wide popularity of the air-cooled gasoline automobile engine, experimenters may obtain on the market engines perfectly suited to the requirements of aerial machines.

Up to within a few years, however, the would-be inventors of flying machines have devoted the greater part of their ingenuity to the propelling features of their usually fantastic creations, and have neglected the problem of maintaining stability. The few machines which have passed the speculative stage, and have been experimented with, have invariably proved wofully deficient in the ability to keep on an even keel in any except the most steady air conditions.

It seems, however, that this problem has remained unsolved so long simply because of this lack of attention to the mechanical principles involved, and not to the difficulty of the problem itself. The kite has been showing inventors the way to secure stability for centuries, but apparently its lesson has been unheeded, as there has never, to the writer's knowledge, been a machine constructed which was even designed to maintain equilibrium on the principle which keeps the kite on an even keel. Let us see what this principle is, and how inventors have neglected it heretofore.

A kite is acted upon by only two forces, one passing through the center of pressure of the aeroplane surface and normal to it, the other acting at the point of attachment of the string and in a direction tangent to the string at this point. If the wind shifts, the kite veers around, always facing the wind and keeping the horizontal component of the string force in line with the wind. It is to this veering of the kite, which results in its always presenting the same edge of its plane to the wind, that we must attribute its stability.

Nearly every aëroplane machine ever designed or built has consisted, besides its particular arrangement of supporting surfaces, of one or two air propellers with their axes *fixed* in a direction to drive the machine ahead, and an arrangement of horizontal and vertical rudders.

How far this arrangement differs in its action from the kite under a shifting wind becomes evident upon a moment's consideration. Suppose such a machine to be facing a wind, and suppose this wind suddenly to shift in direction. It is evident that the machine will not now be in equilibrium, and in order to reestablish its stability it will be necessary to instantly face it around, so that it again presents the front edge of its plane normal to the wind. That this could not be done by any form of rudder is evident, since the turning movement which a rudder is capable of producing depends entirely upon the relative motion of the rudder and the medium in which it acts, and when this medium is the air, shifting its direction of motion continually, it is easily seen that the rudder would prove very untrustworthy.

Let us now see if we cannot design an aeroplane arrangement which, while carrying its own motive power, will perform automatically the exact evolutions of the kite in a variable wind.

To begin with, assume that we have constructed an arrangement of supporting planes, which we know by its similarity to the kite design will fly successfully when a cord is attached to it in a given manner. The problem is then reduced to that of replacing the cord force by the two forces with which we must deal in the practical machine, i. e., the weight of the machinery and occupants, and the pull of the propeller. If we so arrange the machine that both of these forces are applied at the point of attachment of the cord, the weight of the body, machinery, etc., furnishing the vertical component, and the pull of the propeller the horizontal component, their resultant will be a force directed downward and inclined forward exactly like the pull of the cord.

If now the propeller is mounted upon a shaft with a universal joint, the vertical plane in which this resultant acts may be shifted around as we please. The kite, it will be remembered, veers around so as to bring this plane parallel to the direction of the wind; and in our machine, if we shift the axis of the propeller so as to bring it nearer to the new wind direction, it is evident that the machine will veer around exactly as the kite does.

It only remains then to make this shifting of the propeller automatic, and this can easily be done by an arrangement like a weather vane, which, in always pointing at the wind, carries the propeller with it—an arrangement which is used in some wind mills.

If the machine is in motion, the action is just the same as above described, except that by wind we then mean the motion of the air with relation to the machine and not with relation to the earth.

There is one more point worth taking up in this connection, and that is in regard to the amount of the two forces acting on the kite. A change in the strength of the wind acting upon a kite is of course instantly met by a corresponding change in the pull of the string. In the proposed machine this equality might not be secured instantly. But this is of no consequence, since a change in amount of one of two forces holding a body in stable equilibrium cannot destroy this equilibrium, but will simply produce an accelerated translation in the line of the forces.

In the above discussion the word *aeroplane* is not intended to be confined in its meaning to mathematical planes, but includes curved surfaces sometimes called aerocurves.

We have not attempted to analyze stability and classify it as transverse and longitudinal stability, as such reasoning is mere straw splitting, when the kite is stable in its flight and we are apparently able to imitate its action perfectly in a practical machine.

That a machine built on the lines suggested would prove stable in full flight can hardly be doubted; but it is not claimed that such a machine would completely solve the problem of aerial navigation, since there are two more problems confronting the inventor, that of starting up from the ground and that of alighting safely. These problems do not readily lend themselves to a theoretical solution, and will probably have to be worked out by practice with an actual machine.

That these problems increase in difficulty with the size and unwieldiness of the machine is certain; and it seems that success is most certain to follow experiments with a small apparatus built to carry one man. Furthermore, we know that nature has never constructed flying creatures weighing over about forty

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pounds; and although the reasons for this limit are not perfectly obvious, yet the fact in itself must carry some weight.

With engines developing more power per unit of weight than any animal, and with high-grade steels capable of withstanding greater unit stresses per pound of weight than any organic material, it seems that we ought certainly to be able to raise this limit of weight until it includes one man and his machine, and perhaps eventually to construct machines of far greater capacity.

New Ethnic Type Found in Menton Grotto.

The grottoes of Baoussé-Roussé, near Menton, are now being explored for prehistoric remains under the direction of the Prince of Monaco. M. de Villeneuve has been carrying on the excavations, which have yielded some interesting finds, especially of fossil human remains. The chief discovery so far has been a human fossil of a new type. The Grotto des Enfants, where the work has been carried on, yielded two skeletons in 1874-5 which are now at Paris, but less than 10 feet of depth was then explored. M. de Villeneuve has gone down to 30 feet before reaching the rock which constitutes the primitive soil. At 21 feet he found a complete skeleton, and 2 feet lower the last burial place, containing two bodies. Among the fauna are the eland, two deer, one of which is of large size (*Cervus canadensis*), bovidæ, equidæ, and others. The most interesting animal is no doubt the *Hyæna spelæa*, whose bones have been found below three human skeletons at about 20 feet depth. Implements and utensils have been found in considerable numbers. Quite at the bottom were rough implements of limestone and pebble, more rarely in flint. According to M. Cartailhac, who assisted in the work, the lower skeletons should be classed as palæolithic, and have a considerable value. The subject found at 21 feet is a man of great height, 6 feet 4 inches, stretched out on a layer of cinders, charcoal, bones, etc., more or less burned, which constituted the seventh habitation. His feet had been protected by stones and a large block, which, in falling, crushed the head, was no doubt destined to protect the latter. The skull has been reconstructed; the facial part is very low and well developed in length. This individual has the characteristics of the race known as Cro-Magnon. Two skeletons were found which present great interest, as they are of the negroid type. These were buried in the eighth habitation. A small ditch was dug to receive them and a kind of trilith formed of two vertical stones and one horizontal covered the two heads. One is an old woman who lies flatwise with the members strongly folded up, while the second is a young man approaching adult age, lying on the back, and his members are also folded. These skeletons are alike in characteristics and represent an ethnic type which has not as yet been encountered in the quaternary layers. They are of small size (the woman 5 feet 5 inches, the man 5 feet 2 inches) and not very robust. The most curious fact is that the facial part of the skull presents a strongly-marked negro type in the lower portions. The nose is somewhat wide and there exists a sub-nasal prognathism as well defined as in the present negroes of Senegal or other regions, and in consequence, a retreating chin. It is thus a striking fact that individuals of the negroid type have been encountered in this locality at a depth of 23 feet.

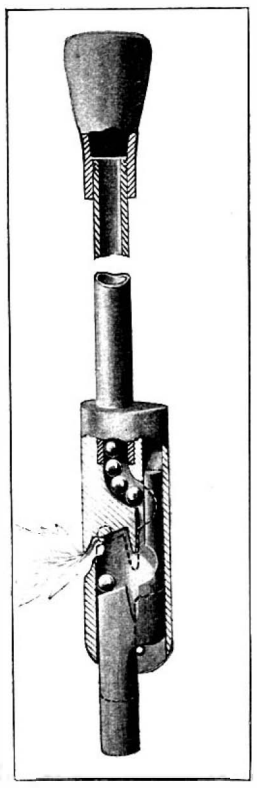
The Current Supplement.

The current SUPPLEMENT, No. 1434, contains a wide variety of instructive articles. Harold J. Shepstone gives an excellent description of the new harbor works at Dover, illustrating what he has to say by many clear pictures. George J. Burch tells something of a new capillary electrometer. Sir Oliver Lodge concludes his discussion on electrons. "Painting by the Acre" is the title of an entertaining article which tells how the great transatlantic liners are kept in trim, and gives one some idea of the difficulty of counteracting the effects of the sea water on ocean steamships. Ever since it was discovered how water could be electrically decomposed, inventors have sought to make use of the discovery for the purpose of utilizing the oxygen and hydrogen liberated. Emile Guarini describes the Garuti process for attaining this result. Prof. Arthur W. Goodspeed's remarkable discovery of new emanations from apparently inactive bodies is fully discussed in a paper from his own pen. Profs. Henri Moissan and James Dewar outline certain experiments on chemical affinity at low temperatures as determined by the reaction of liquid fluorine. Edmund Ledger reviews our present information of the much-discussed canals of Mars.

The largest ferryboat in the world was launched May 23 at the Schichau Shipbuilding Works, at Stettin. The boat is designed to carry whole trains over the Baltic Sea between Warnemuende and Gjedser, providing direct communication with Copenhagen.

A SAFETY MAGAZINE TORPEDO CANE.

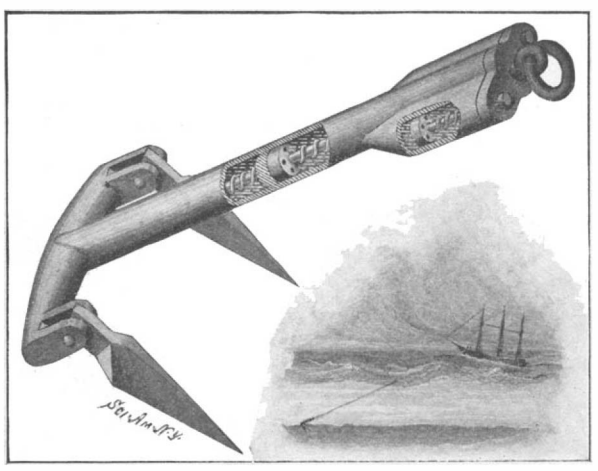
With our national holiday only a week off, the patent just granted to Mr. John H. Rese, of Alleghany, Pa., is of timely interest. The patent covers the invention of a magazine torpedo cane arranged to positively feed the torpedoes out of the magazine and safely explode them in a casing which is so arranged that the flames or burnt products of the exploded charge will be prevented from returning to the magazine and exploding its contents. As shown in our illustration, the main rod of the cane is hollow, and serves as a magazine in which the torpedoes may be stored. At the lower end of the cane a casing is secured, in which a plunger is adapted to slide. The plunger is provided with a recess, which registers with the lower end of the magazine when the plunger is forced up to the position illustrated in dotted lines. The recess is of such size as to receive only one torpedo at a time, which is carried down with the plunger when the latter drops to the normal position, and is permitted to roll out into the explosion chamber. Now, on striking the end of the cane on the ground, the plunger is forced upward into the casing, exploding the torpedo by crushing it against the upper wall of the chamber. The fumes and burnt products of the explosion are blown out through the opening at the side of the chamber, being prevented from passing up to the magazine by a tongue which projects down into a slot in the plunger. At the same time the recess in the plunger is brought into position to receive another torpedo from the magazine. On lifting up the cane, the plunger drops by gravity, carrying this torpedo down to the explosion chamber, where it is exploded on the next blow. The process may be repeated as often as desired, or until the magazine is entirely exhausted.



A SAFETY TORPEDO CANE.

ANCHOR WITH YIELDING CHAIN CONNECTION.

In order to prevent the breaking of anchor chains by sudden shocks or pulls due to the motion of vessels while at anchor, Mr. William A. Duncanson, of Falmouth, Nova Scotia, has invented an anchor having a yielding connection with the chain. The shank of the anchor is tubular, and movable within the shank is a rod to the outer end of which the anchor chain is secured. The hollow shank is divided into two chambers by a center partition. Through this the rod passes and is provided with two perforated pistons, one above the partition and the other at the lower end of the rod. The chambers are filled with oil or similar material not subject to freezing. A crosshead secured to the rod at its outer end is provided with two auxiliary pistons, which operate in cylinders at opposite sides of the main tube. The pistons are normally



ANCHOR WITH YIELDING CHAIN CONNECTION.

held in the positions illustrated by coil springs on the piston rods. In operation the pistons are drawn out by any abnormal pull on the anchor chains. The shock of a sudden pull, however, is absorbed by the cushion of oil against which the pistons are drawn. By perforating the pistons the bearings thereon will be relieved to some extent, for the liquid will pass through these perforations as the pistons move upward. The auxiliary pistons and springs serve to check the continuous draft on the main pistons and springs, that is, when the auxiliary devices are completely compressed, the main devices will not be fully compressed, so that a complete elastic cushion is obtained. The springs on the piston rods serve to restore the pistons to their normal positions upon the slackening of the anchor chain.

Engineering Notes.

The first British use of the Hall signaling apparatus is to be carried out upon the North-Eastern Railroad of Great Britain. Hitherto this system has been tested experimentally only in this country. The section of track upon which the apparatus is to be installed is between Alne and Thirsk, a distance of about 11 miles. In the Hall signaling system the normal position of the semaphore is horizontal, indicating "danger." By means of an electrical appliance fixed to the track the train as it approaches the semaphore lowers the arm of the latter, provided the section in front be clear; but should there still be any wheels on the rails of the section, this operation is automatically rendered impossible. It is proposed to equip the installation with Raven's patent fog-signaling apparatus, and to work the semaphore arms by compressed carbonic acid gas. Each signal post will have a cylinder of gas stored at its base, and the gas is to be conveyed to the semaphore arms by means of an electric device. Should this installation prove reliable and efficient upon this section, it is to be extended throughout the whole system.

The work of towing off the large floating dock for Durban, which was wrecked on the rocks at Mossel Bay, South Africa, during a storm, while on the way out, has proved more difficult than was anticipated, owing to the difficulty in obtaining hawsers sufficiently strong to stand the tremendous strains that have to be exerted. The authorities engaged in salving the structure also found that there was no large vessel sufficiently powerful to accomplish this work, and the battleship "Monarch" was requisitioned for the purpose. By this means the dock was hauled 100 feet seaward, but at this critical point the hawser parted. A fresh hawser specially for the purpose has now been ordered from England. It is to be 3,120 feet in length, consisting of 720 feet of 18-inch Manila cable, with 1,200 feet of 7½-inch steel wire at each end. The dock only requires power and an unbreakable hawser to refloat her, and it is considered that the damage will not be so severe as was at first supposed.

In a recent number of Cassier's Magazine may be found an interesting discussion of the modern use of suspension bridges. From time to time the statement is made that suspension bridges are things of the past, and that cantilever and other structures have superseded them. As an instance a correspondent of one of the New York daily papers recently maintained that "when the problem of really consolidating the city of New York with its great neighboring cities, to the east and west, is really taken in hand, it will not be solved by suspension bridges, typical of the engineering of the early years of the last century, but rather by tunnels or by great steel tubular and girder structures, which will link the railroad systems, as well as the thoroughfares of the cities." As to this, however, it is proper to point out that the old form of suspension bridge is an antiquated, superseded structure in only the same way that all old designs are antiquated and superseded. It is not the principle that is wrong; it is that the details are behind the modern methods of construction. To eliminate the suspension bridge from modern work would be to deprive engineers of a form of construction which has special adaptations and which modern science cannot afford to give up.

A contemporary remarks that a recent computation has placed the total aggregate power of steam turbines in use or under construction or ordered in different parts of the world at over 500,000 horse power. Of this total the major portion is used or to be used for the driving of dynamos, alternators or other electrical machinery, while the next in point of power consumption is marine engines. An item in point is the contract recently given to the British Westinghouse Electric and Manufacturing Company, Ltd., by the Metropolitan District Railway Company, of London, England, for four turbo-alternators. Each of these machines is designed for a normal capacity of 5,500 kilowatts, but will be capable of carrying an overload of 50 per cent, giving for each unit a maximum output of 8,250 kilowatts, or about 11,000 E. horse power. These turbines will be not only the largest steam turbines ever made, but also the most powerful single cylinder engines of any type whatever in the world. Very few multiple cylinder engines existent have greater power. Notwithstanding the enormous power they will develop, the dimensions of these engines are only 29 feet in length by 14 feet wide, by 12 feet high, the overall length of turbine and alternator being 51 feet 9 inches. The steam pressure will be 165 pounds per square inch, and the speed 1,000 r. p. m.

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THE "TELEPHOT," A NOVEL APPARATUS FOR PHOTOGRAPHING AT GREAT DISTANCES.

BY DR. A. GRADENWITZ.

An interesting communication on telephotography was read before last year's Congress of Swiss Naturalists, by Mr. A. Vautier-Dufour. The author has experimented in this field for many years past, and is keenly alive to objections urged against telephotography. He has however obtained excellent results by means of a telescope, the objective of which has a focal distance as great as 2.40 m. The eyeglass was removed so that the image was formed at the focus of the objective. The author hence inferred that this process would best suit his purpose. The only drawback was the difficulty of carrying so cumbrous an apparatus about. With the assistance of the Geneva astronomer, Scheer, the problem was solved. Both constructed an apparatus with an objective 16 cm. in diameter and 2.40 m. in focal length, the latter being reduced to the third part of its value, by inserting two plane mirrors between the objective and the plate. The losses by reflection of these mirrors did not exceed 5 per cent. Exposures of 10 seconds were required when yellow screens and orthochromatical plates were used, while without a screen excellent snap shots could be taken with exposures of about 1-75 sec. The total length of the apparatus was only 3½ inches.

Vautier-Dufour is now constructing an apparatus 40 cm. in length, the diameter of the objective being 0.10 cm. and the focal length 1.20 m. It is hoped to obtain good instantaneous photographs with exposures ranging between 1-200 and 1-500 sec. The same apparatus may be used to take ordinary photographs with an objective 0.25 m. in focal distance.

The following advantages are claimed for this ingenious device, as compared with tele-objectives—greater intensity, better definition, higher magnification, and an easier adjustment. As regards the neatness of images, the views presented before the members of the congress were perfectly sharp as far as the edges of the field of view. Twelve-fold magnifications were obtained, without the apparatus ceasing to be portable.

Telephotography in its new form is likely to prove useful both for scientific and industrial purposes, as well as in warfare. The physicist will be able to photograph any phenomenon visible at the extreme horizon, such as mirages, etc., as well as those which he could not approach himself without danger, such as, for instance, volcanic eruptions. The naturalist may now safely observe wild animals and photograph them from a distance. The amateur astronomer will be in a position to take splendid views of the principal heavenly bodies. The explorer of Arctic regions will observe, by means of the "Téléphot," distant and inaccessible points. Archæologists and architects will use the apparatus to fix on the photographic plate buildings and monuments too distant to be taken with an ordinary apparatus. Military and naval officers will be able to observe and to study the movements of the enemy (the apparatus may in fact be well used as a telescope); finally, all topographical measurements will highly profit by this ingenious apparatus.

The scheme of the apparatus, as constructed by Messrs. Boissonnas & Co., Ltd., Geneva, Switzerland, is shown in the diagram. The rays emerging from the objective *A* will strike the plane mirror *B*, by which they are reflected on the second mirror *C*, to be conveyed after another reflection, to the photographical plate placed at *D*. By substituting for the long-distance objective an ordinary one (with a focal distance of 20 or 30 cm.), the apparatus may be made to serve for ordinary photographs. The "Téléphot" may, moreover, be, at a moment's notice, converted into a terrestrial or astronomical telescope.

The Telephotographic Apparatus.

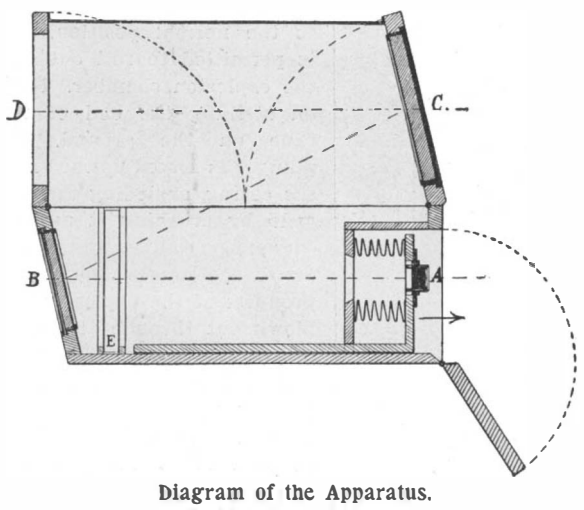

Diagram of the Apparatus.

Our illustrations show the apparatus set up for use, as well as some photographs taken with it.

COALING WARSHIPS AT SEA.

BY HERBERT C. FYFE.

For some little time past experiments have been carried out both in British and American waters with apparatus for coaling men-of-war while steaming on the high seas.

These experiments, so far as the United States navy is concerned, have reached a practical conclusion, and the U. S. battleship "Illinois" is now completely fitted with an apparatus for taking coal at sea. She is the first warship to be completely equipped with the marine cableway, and her equipment will permit her to take coal at sea from any masted vessel. The Imperial Russian battleship "Retvizan" is also equipped with a similar installation which is giving satisfactory service.

In Great Britain the apparatus with which experiments were made consisted of a cableway fitted on the "Muriel" collier. It has had several sea tests and the results were considered highly successful. The collier delivered thirty-five to forty tons of coal per hour in a moderate sea and half a gale of wind to H. M. S. "Trafalgar," the battleship towing the other at speeds varying from eight to eleven knots per hour.

The idea of placing all the appliances for coaling at sea on a warship did not at first find favor in the eyes of many American naval officers, who argued that battleships were already overloaded with machinery and that to carry the apparatus on board would require a number of important changes in the disposition of material located in more or less essential places.

The U. S. Navy Department selected the "Illinois" for the installation and the equipment is being successfully operated. The only machines required for the warship were two special operating winches, but these were so designed that they served a double purpose and displaced two deck winches which were already on the superstructure deck of the "Illinois."

The new winches now perform all the functions of the old ones besides their own particular work, and they occupy precisely the same bed and employ the same foundation bolts as the old ones. These winches work the load carriage running between the collier and the warship. One winch draws the loaded carriage toward the warship, the other winch draws the empty carriage back to the collier.

A single wire rope ¾-inch diameter, 2,000 feet long is employed for this purpose. Both winches run all the time in the same direction and the ropes are always taut. The reciprocating motion is given to the load carriage by the friction of one slipping drum overpowering the other. The drum of one winch is always winding in rope. The drum of the other is always paying out rope under tension of the slipping of the friction-heads. The great point about this method of operating a load carriage is that it is independent of the relative motion of the two ships. When the ships pull apart one drum slips, thus paying out the rope; when the ships approach each other, the slack given to the rope is wound in. It is of course essential that the rope speed of the winches be greater than the speed at which the ships approach each other.

The operating levers on the after bridge occupy a space of about 1⅛ square feet between two ventilators in the center of the ship, and it is here that the operator takes his stand in full view of the load carriage at all times in its passage to and from the collier.

The remainder of the equipment on the "Illinois" is to be found just below the steering compartment and beneath the platform deck. It consists of the following items: A reel suspended from the deck carries 2,000 feet of ⅞-inch diameter sea-anchor line (weight 2,640 pounds). There are also two ¾-inch diameter conveyor lines (weight each 508 pounds) and two sea

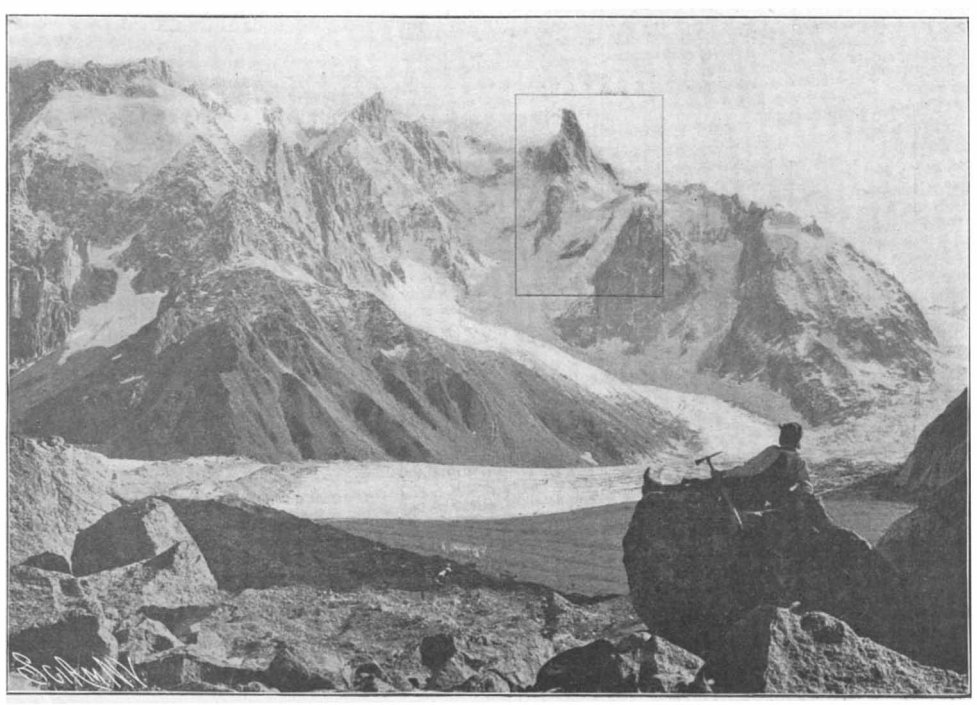

Fig. 1.—Aiguille du Geant seen from Mer de Glace (Mont Blanc.) Photograph Taken with an Ordinary Lens.

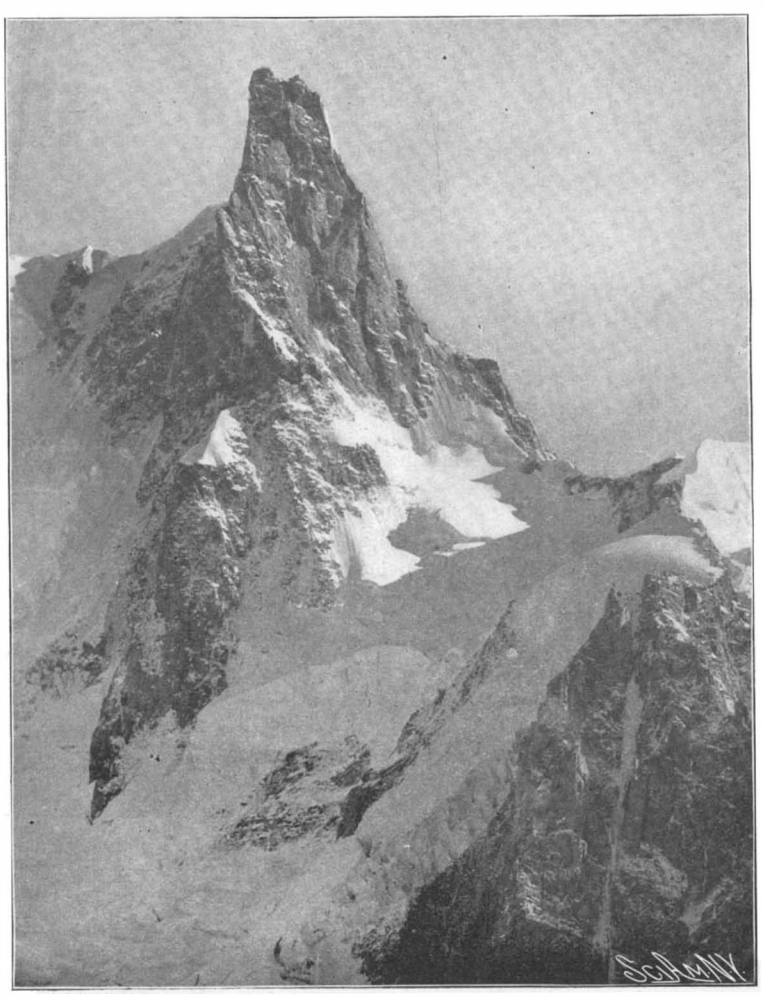

Fig. 2.—Aiguille du Geant. Telephotograph of the Peak Marked in Fig. 1, taken from Mer de Glace (Mont Blanc).

THE "TELEPHOT," A NOVEL APPARATUS FOR PHOTOGRAPHING AT GREAT DISTANCES.

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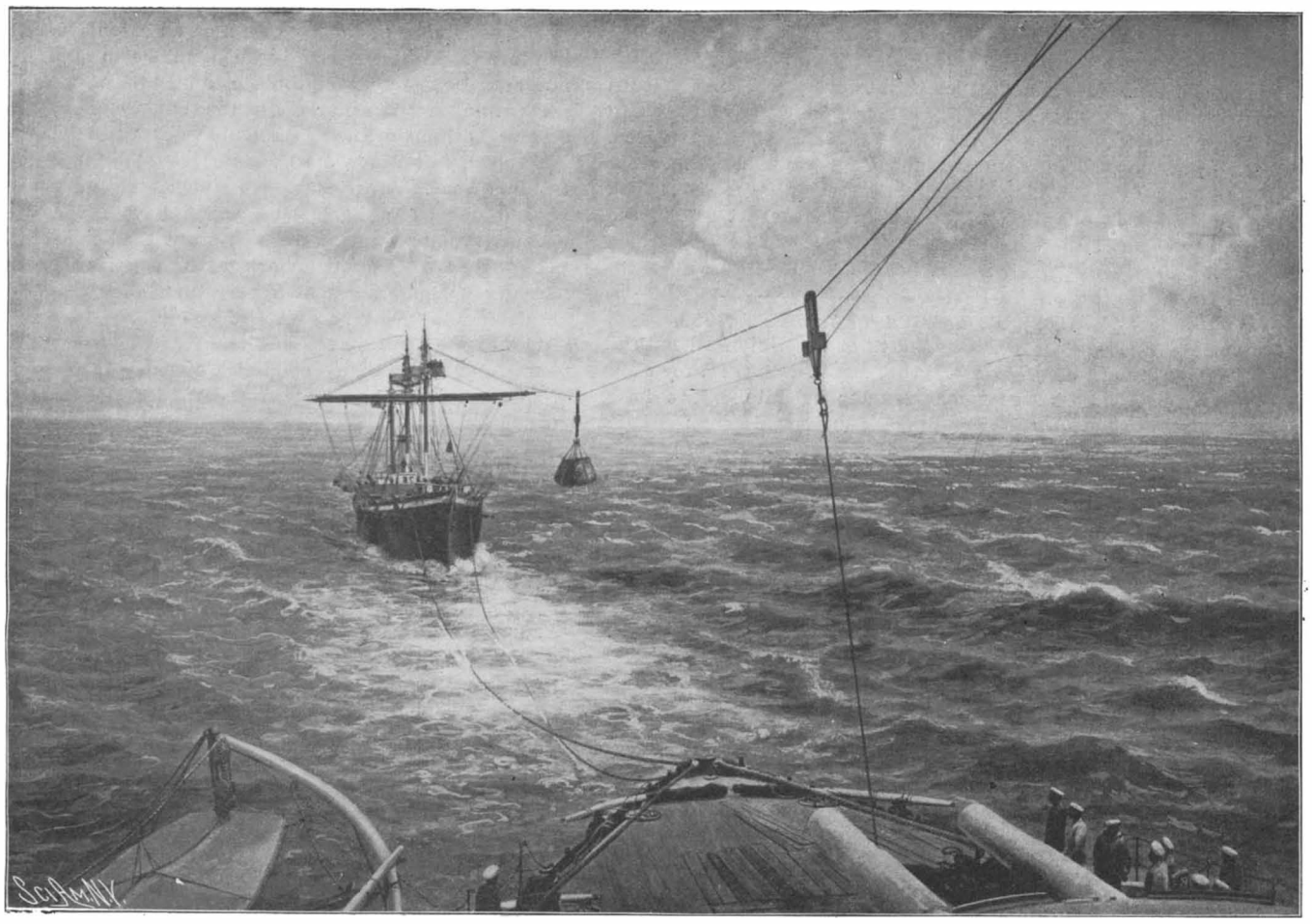
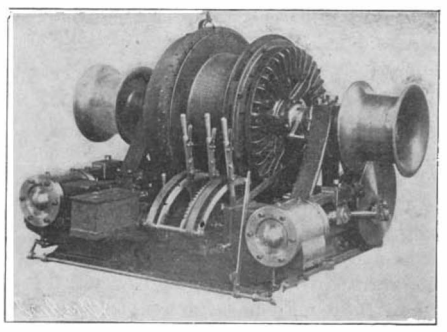
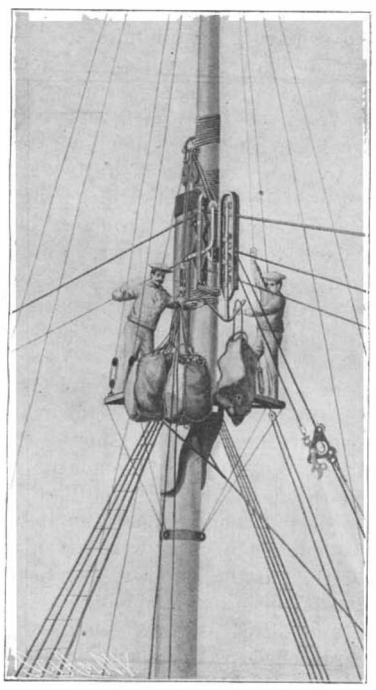


Looking Aft from a Warship Coaling from a Collier Towed Astern.

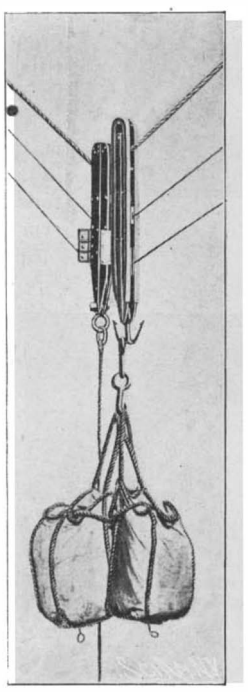
Elevating Truck Loading Bags on the Deck Ready for Hoisting to Masthead.



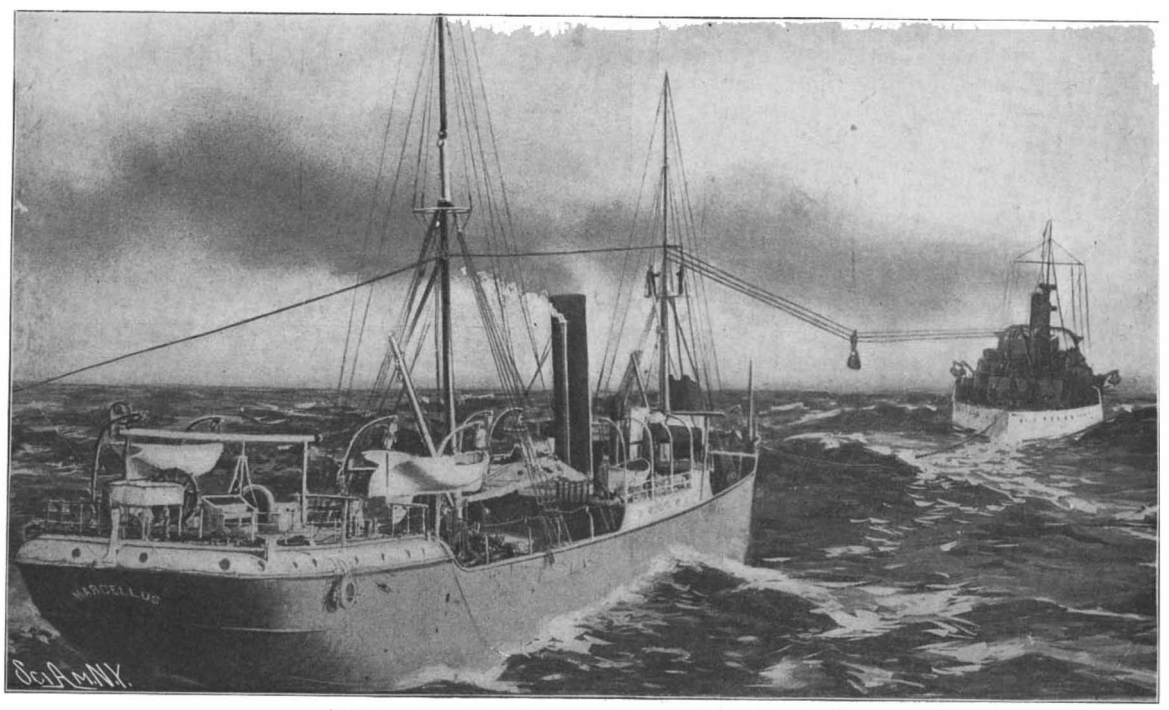
Cableway Winches on U. S. S. "Illinois."



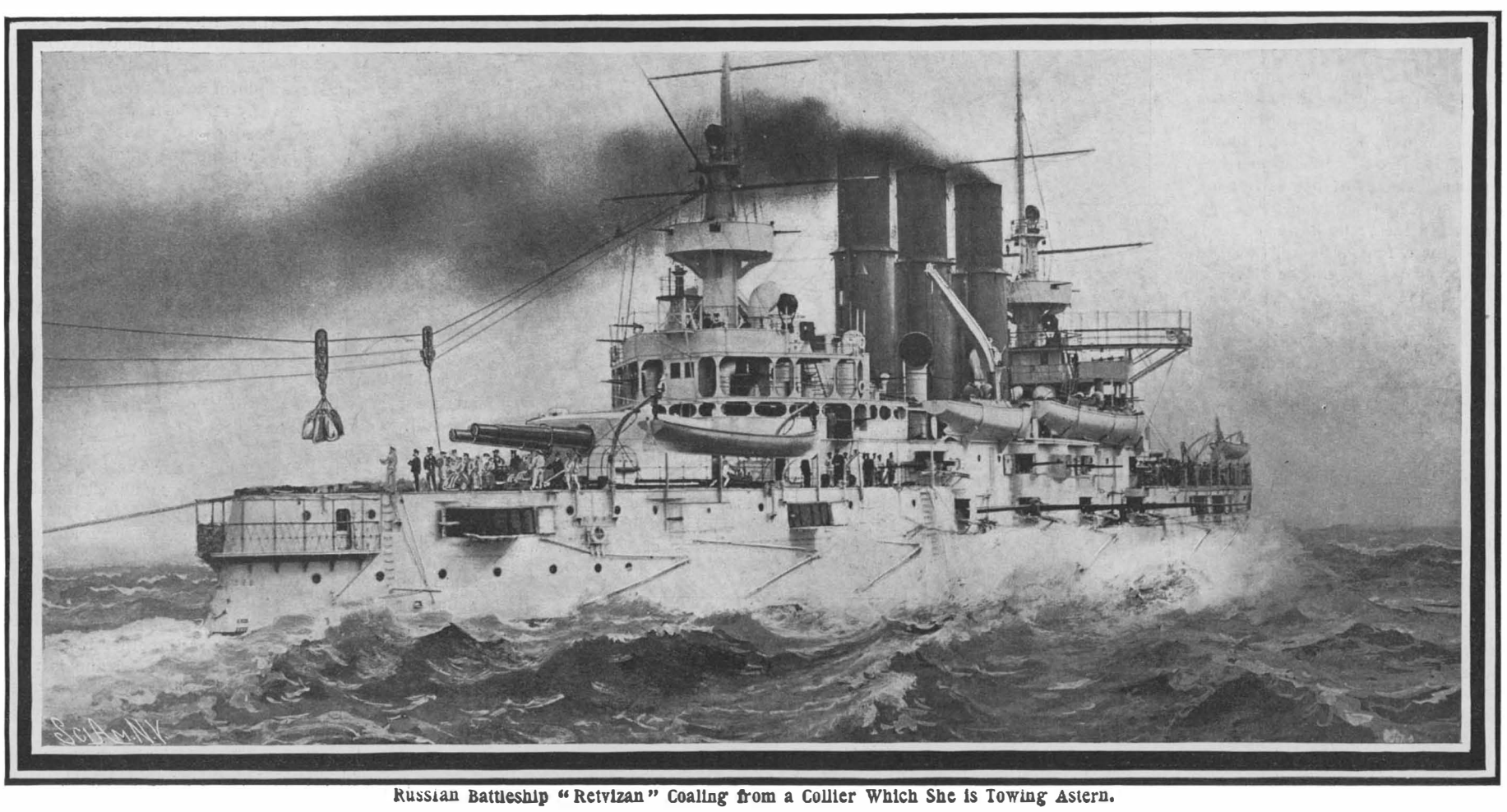
Transferring Full Coal Bags and Removing Empty Bags.



Loaded Carriage and Hauldown Block.



Collier "Marcellus" Coaling the "Massachusetts."



Russian Battleship "Retvizan" Coaling from a Collier Which She is Towing Astern.

COALING WARSHIPS AT SEA.

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anchors. Then there are the hauldown block carriage, loading blocks, etc., all of which occupy a space just below the deck 16 feet long, 7 feet wide, and 4½ feet deep.

Several improvements have been made in the marine cableway since the early experiments between the U. S. battleship "Massachusetts" and the collier "Marcellus." The sea anchor line is now ⅞-inch diameter in place of ¾-inch as formerly, and it will easily sustain the tension due to conveying one ton of coal. The sea anchors have not been altered in any way. The coil spring (weighing 1,200 pounds) attached to the mainmast would be completely compressed under a load of 20,000 pounds, but a 12,000-pound strain is all that is required to carry a load of one ton. As the warship dips and rises in the waves, the spring will compress and elongate in uniformity with the ship's motion, and this serves to equalize the somewhat varying strain on the sea anchor. This spring as used on the "Illinois" is 8 feet long and is heavier than that used on the "Massachusetts."

The load carriage works very simply. It contains three wheels and a "grip" arranged in a vertical line. The elevating devices can be stowed away on the warship and set up on board a collier at sea in a very short time. A sheave block is lashed to the foremast and mainmast, and these support the sea anchor line and allow it to play freely through them. Just below is the tail block, about which the conveying line bends. At a point above the sea anchor line another lashing is made, and two ¾-inch wire guy ropes are there attached and led forward to the starboard and port sides of the ship, where they may be attached to the deck at almost any place found convenient.

Loads can be hoisted from the port deck and then the starboard deck, alternately, to the two men at the masthead. One of these takes in his hand the loose ring which is attached to the elevating hook. When the load carriage reaches the collier's masthead, the ring is placed by hand over the hook of the carriage, a lever is pulled on the elevating truck and the load is dropped and thus transferred to the load carriage. This operation can be accomplished in two seconds. The other man takes off the empty bags on their return from the warship, and sends them down to the deck for refilling.

In the original experiments on the U. S. S. "Massachusetts" a pair of shears was erected and guyed for the support of a large canvas chute through which the bags of coal were dropped. All of this has since been dispensed with, the ropes of the cableway being all pulled down by a nigger-head on the quarter-deck winches when it is desired to dump the load.

The improved method of delivering the coal is as follows:

The load starts out from the collier on a downhill route, continuing so for more than half the distance. When the load is just clear of the center of the span and is in its lowest position the man on the quarter-deck of the warship commences to pull down the hauldown block. By the time the bags reach the block they will be trailing on the deck. The operation now stops for an instant, the lowering continues for a foot or more, the load is unhooked from the carriage, empty bags are put on, and the whole apparatus is then raised to its normal position. At the same time the operator on the after bridge sends the empty carriage back to the collier for another load.

The Return of the "Gauss."

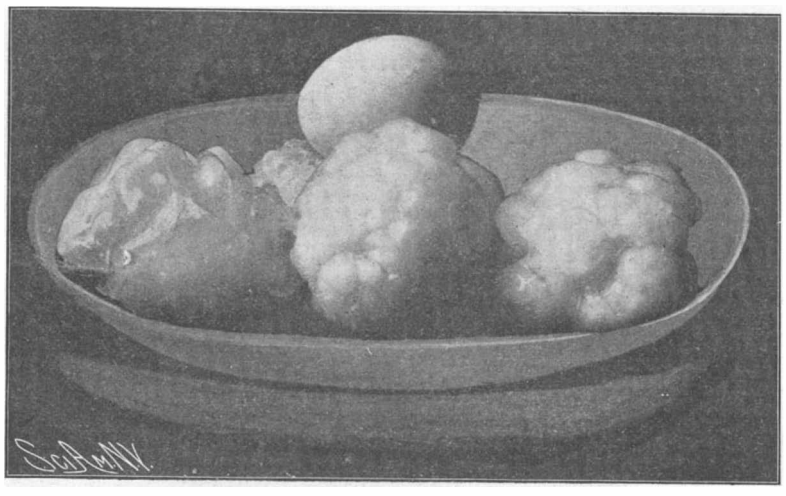
After a comparatively brief sojourn in the Antarctic regions, the German "Gauss" expedition returns with little, if anything, new to narrate. Despite the fact that provisions sufficient in amount to sustain the party for three years had been taken along, the enterprise was abandoned comparatively early. The reason is doubtless to be found in the fact that when the ship was frozen in, only a month remained before the arrival of the equinox, and with it, the long polar night. Dr. Drygalski had hoped to find winter quarters in east longitude 90 and to penetrate as far south as the 70th parallel near Termination Island. As a matter of fact, the "Gauss" never proceeded farther south than 66½ degrees south latitude. The British expedition has certainly done better, for by the last accounts Capt. Scott had attained the 82d parallel.

With the Germans out of the field, there still remain the British, Swedish, and Scottish expeditions. It remains to be seen whether they will accomplish more.

Dr. Drygalski's party, however, did not return empty-handed. Much that is new regarding ocean depths, marine flora and fauna has been gathered. Observations of auroral and magnetic phenomena were also made which will doubtless clear up many a dark spot in our limited knowledge. The exact extent and value of the exploration carried out can be determined only after a full report has been published.

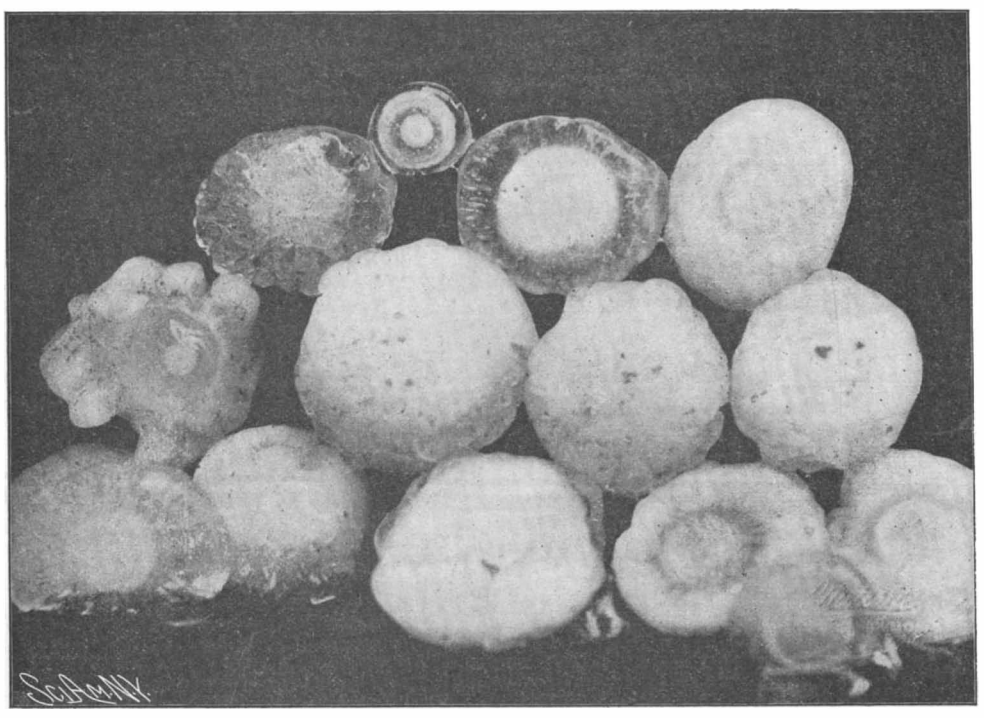
HAILSTONES LARGER THAN HENS' EGGS.

In the vast Western States of the Union all natural phenomena are on a great scale. Rivers are wide, deep, and of enormous length; mountains are lofty and rugged, with summits clad in eternal snow; gorges, valleys and canyons are of stupendous depth; there are cyclones, tornados, blizzards, avalanches. Here are some hailstones that fell in Nebraska during a summer storm on July 2, 1900. As the photograph, which is sent by Mr. Arthur Inkersley, of San Francisco, clearly shows, the hailstones are considerably larger than the hen's egg which has been photographed on the same dish for purposes of comparison.



HAILSTONES THAT FELL AT ALLIANCE, NEB.

On Top of the Heap is a Hen's Egg.



HAILSTONES THAT FELL AT YORK, ENGLAND.

The other picture shows some hailstones which fell at York, England, on July 8, 1893. While these are evidently large stones, it is not easy to say just how large, as no well-known object has been photographed with them.

A Disastrous Flood in the West.

Several hundred people lost their lives in a cloudburst that almost entirely destroyed Heppner, Ore., on the night of June 14. The flood came with such suddenness that the inhabitants were unable to seek places of safety. Huge bowlders weighing a ton were carried down by the current. Two-thirds of Heppner was swept away by the flood.

Columbia University's Honorary Degrees to Scientists.

Nine honorary degrees were awarded at the recent commencement of Columbia University. Peter Cooper Hewitt and Prof. Joseph J. Thomson were made Doctors of Science. The degree of LL.D. was conferred upon Prof. Humphreys, of Stevens Institute of Technology. Peter Cooper Hewitt was presented for the degree by Prof. Michael I. Pupin.

Raising Cotton in the West Indies.

The possibility of raising cotton on an extensive scale in the West Indies, especially Cuba and Porto Rico, has not been considered improbable, and agricultural experts who are familiar with the climate, soil, and other conditions of these islands have expressed the belief that a fair grade of the staple could be produced in abundance. A series of experiments have recently been concluded in Porto Rico which have a very important bearing on this subject, since they appear to not only prove the conclusions of the experts, but apparently demonstrate that a very high quality of the staple can be grown.

The experiments have been in progress about three years, and have been conducted by several planters from Alabama, who are conversant with the form of cultivation in the Southern States. At first a small area was planted with the seed. The results were so satisfactory that this has been increased from year to year, until in 1902 the acreage aggregated about 9,000, the cotton being grown in sixty different plats. The average production in 1902 is announced to have been about 500 pounds to the acre, or equal to one bale. As is well known, this is considerably more than the average yield in the Southern States, but perhaps the most interesting feature was its quality. Samples of it were sent to expert cotton handlers in New Orleans, Charleston, and Savannah, as well as Liverpool and Manchester. It is stated that all of the judges pronounced the staples practically as good as the product of the islands off the coast of South Carolina and Georgia, or, as it is generally termed, the Sea Island cotton—by far the best staple grown in America. The success attending the cultivation so far has determined the promoters to plant about 12,000 acres this year, and a company has been organized to construct an oil mill and fertilizer works in connection with the plantations, with the view of manufacturing the by-products from the cotton seed. Estimated by previous crops, it is calculated that in addition to the cotton itself fully 7,000 tons of seed will be secured, which, when crushed, will produce at least 250,000 gallons of oil and 5,000 tons of fertilizer. Consequently the by-products will represent in themselves an important source of revenue to the company.

So far as known, this plantation is the only one where cotton has been produced in commercial quantities in Porto Rico. Should the harvest continue to be as large in proportion to the area cultivated, however, it would appear as if an excellent opportunity were given to add this to the other resources of the island, and undoubtedly the results achieved by the company will be watched with much interest. The fact that the staple is equal to the Sea Island in fineness and length of texture is in itself of much importance, since such a small quantity of Sea Island cotton can be grown in the United States. Should Cuban planters follow the example of Porto Rico, there is apparently no reason why they should not produce an article of equally as high a standard; and with cotton added to the agricultural resources of the two islands, it might in future prove a source of wealth almost as important as that derived from coffee, tobacco, and other staples. On the Porto Rico plantation, native colored labor has been employed, as there is an abundance of this kind, but the Americans have superintended the various processes. The site of the plantation is considered to be no more favorable than many other localities, but was selected more for its shipping facilities than the fertility of the soil.

Arrangements are being made for the equipment of a large plant in England for the manufacture of the Locke sprocket chain. This is one of the first substantial acknowledgments of the American automatic machinery in that country, and as the machine represents the most perfect type of automatic action, it is being regarded with great interest at present in that country. In this machine, a tape of soft steel is fed in on one side, and it emerges at the other in the form of a perfect chain. It is then hardened and is ready for use. The Locke chain has entered into very general use in this country, having been found especially desirable in the manufacture of farming machinery. For this purpose it is used exclusively by one of the largest firms in the world, which is an American concern.

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INTERESTING FACTS ABOUT PELICANS.

BY CHARLES F. HOLDER.

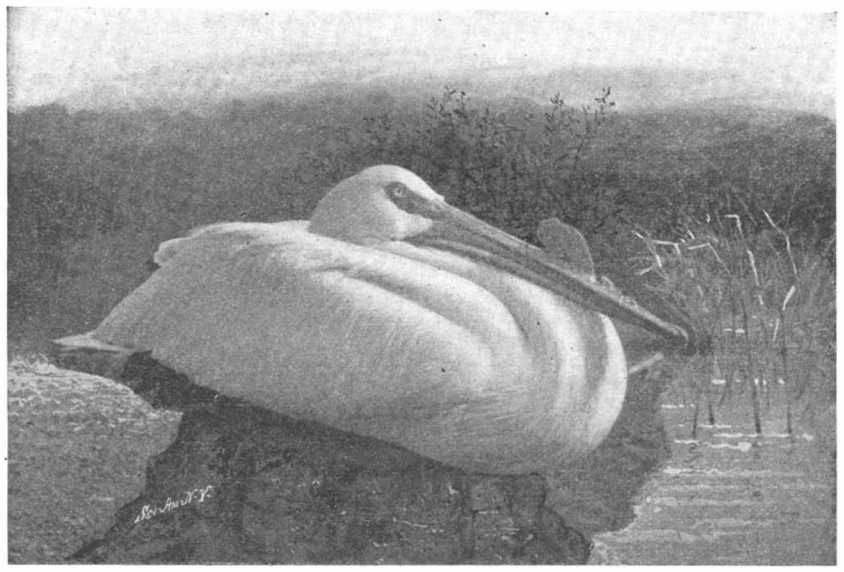
Among the birds the pelicans are possibly the least attractive from an esthetic point of view, and this is not hearsay, as I have been the fortunate—or unfortunate—owner of divers pelicans ranging from the sear and yellow leaf to the extraordinary creature just from the egg; have had them as pets and as serfs, and I have no desire to continue the acquaintance, for the brown pelican is a disagreeable, wheezing, asthmatic bird which would take as much pleasure in plunging its hooked beak into the eye of friend as foe—a bird with an insatiate appetite and of atrocious habit. Notwithstanding this the pelican has some interesting ways and features.

The pelicans at Garden Key, Fla., or its vicinity, nested on a key just above water, upon which were a few mangrove trees, the nest being the rudest possible structure, formed of twigs and wood dropped among the branches, the result being a mound rather than a nest upon which the eggs—one or two—were laid. The young, when they appeared, were at once confronted by an army of land crabs that contested every meal with them. In some inscrutable manner the young birds survived, and at the age of six weeks were most extraordinary objects. Two such individuals I secured, the object being to see how amenable the pelican was to the taming process, and of the many experiments with them one is distinctly impressed upon my memory. I cannot recall that the pelican ever refused food; after the most impossible feeding it had the same dejected, half-starved attitude and the same asthmatic cry for more. It was only after many months that I made the startling discovery that the pelican can never be satisfied.

An old fisherman employed two of these birds to round out the comforts of his life. He placed straps about their necks, then sent them out fishing, when they would fill their enormous pouches with fish and, unable to swallow, would come swimming in; in this way the old man obtained a certain amount of his bait. This is the only use to which I saw the pelican put, at least alive; the skin is the fashionable costume of the Seri Indians of Tiburon Island, and the curious bill is employed in various ways, the wing-bones as pipe stems; but alive the pelican has a very limited economic value.

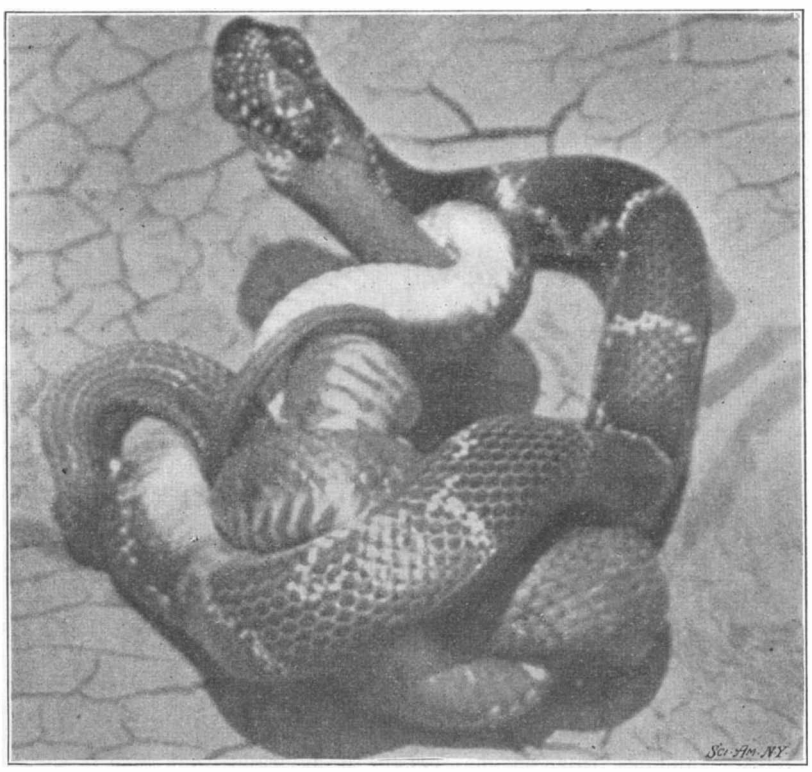
My birds became perfectly tame and followed me about the reef, often above the boat; when weary sometimes alighting on it, and when ashore roosting on a scantling near the boathouse of an old fisherman. When approached they emitted a remarkable and depressing series of cries, so perfect in their imitation of a human being in the violent stages of asthma as to produce a painful effect on ordinary nerves. The pelicans were extremely stupid, for while they would, as suggested, use their bills on their owner when feeding them, they did not have sense to repel the most flagrant robbers of the reef. In feeding they generally flew twenty to thirty feet above the water with rapid motion of the powerful wings, holding the head slightly upon one side that they might observe the schools of sardines. When the latter were sighted they would plunge blindly downward, opening the mouth widely just before they reached the water, endeavoring in this clumsy manner to catch the fish which, not being able to see upward, were entirely ignorant of the nearness of danger. This was usually successful, and here I noticed a difference between the Florida and California brown pelican. The former in this plunge would not go out of sight, while the latter, diving from a greater height, often entirely disappears. Rising after the plunge the pelican invariably wags its diminutive tail—a self-congratulatory act, which confirms the bird's stupidity, for the chances are one to five that it has caught nothing. The bills are held upward, the water allowed to run out of the enormous pouch, and then, if any game has been caught, the pelican tosses its beak upward, which throws the fish forward or toward the point of the beak where it is often held for a few seconds, from here being dropped, as it were, into the throat, which is a very small orifice in a veritable waste of pouch. At this moment, perhaps, a laughing gull robs the pelican. Sometimes it alights on its back, again on its head, and the stupid bird makes no resistance, the gull often uttering its victorious "ha-ha!" in advance. Just as the fish is thrown to the tip of the beak and protrudes from the side, the laughing gull leans forward, snatches it and rises aloft to, in turn, be followed by the swift man-of-war bird. In this simple way a pelican will be robbed by successive birds, and will swallow but a small percentage of what it catches, which possibly explains why it is always hungry.

In the accompanying illustration is seen a white pelican, *Pelicanus erythrorhynchos*, the most interesting member of the group. It appears to be a mounted specimen, but the photograph is from life, and is introduced to illustrate a remarkable feature. On the upper bill will be seen a crest, "dorsal fin," "centerboard," or other local names being given it. It varies



THE WHITE PELICAN, WITH THE CRESTED BILL.

in shape in different individuals, and in the same birds. The crest is shed at times—an interesting fact discovered by Mr. Robert Ridgway, the distinguished ornithologist, who made the discovery at Pyramid Lake, Nevada, some years ago. The peculiar crest is a very conspicuous object, and at one time it was supposed to be an ornament, and described as such, peculiar to the male. Mr. Ridgway found the birds nesting in May at this lake, the nests being masses of sand and gravel six or eight inches in height and twenty inches across, upon which was deposited one egg, the male standing or sitting by the female while the latter was on the nest. In July Mr. Ridgway observed that the birds had no "centerboard," or crest, but in May, when the birds were nesting, a large proportion of both males and females were provided with the crest. He learned that, from this time on, the birds cast or shed their crests, the curious objects being found about the nests; by the last of May all the birds were without this singular feature, the ground in certain localities being strewn with them. It would appear, then, that the crest comes with the breeding season and disappears about the time the young appear or the hatching process begins.



KING SNAKE KILLING A WATER MOCCASIN.

Photographed from Life.

The white pelican is often seen in winter in Florida, and I have observed flocks on the Pacific coast going north. So far as my own observation goes, the brown pelican of Florida nests in trees; the brown pelican of California on the ground. The latter dive from above to capture their food, the Florida species not making so high a dive. The white pelican never dives, but swims along the surface, capturing its prey in an ab surdly simple manner, almost inconceivable when the shyness of mullet and sardines is recalled. Dr. D. G. Elliot describes it as feeding by swimming along, "beating the surface of the water with its wings and scooping up great numbers of fish at once."

A BATTLE BETWEEN TWO DEADLY SNAKES.

BY W. T. BRYAN.

Some two years ago it was my good fortune to witness a combat between a king snake and a water moccasin, and to secure the photograph from which the accompanying engraving is reproduced.

I was attracted to the scene by a negro laborer. When I reached the spot, I found the snakes coiled together in a pool of water, the king snake gripping his enemy with the tip of his tail, just back of the head. It was clearly his intention to drown the moccasin. For the purpose of taking my picture, I lifted the two struggling, writhing serpents to a rock. Just before I took my photograph, the king snake pulled the moccasin's head in the exact position he wished, and quickly stretched his jaws over it. It was then that the photograph was taken. Thoughtlessly enough, I put the snakes back into the water, thinking that the king snake would also drown. Very soon, however, he left the pool, stretched his victim straight out before him and leisurely began to swallow him. In my efforts to take another photograph, he was frightened away. Both snakes were nearly the same size, being about three and one-half feet in length.

To Lessen Damage by Forest Fires.

Last year within two weeks over $12,000,000 worth of timber and other property was destroyed by forest fires in Oregon and Washington. This enormous loss occurred upon a restricted area and represents only a very small part of the annual loss from this source. Every timbered region of the United States suffers year after year from fire. The annual loss is estimated at from $25,000,000 to $50,000,000. Forest fires have been regarded as almost inevitable, and few systematic attempts have been made to prevent or control them except in the States of New York, Pennsylvania, and Minnesota, which have efficient systems of fire protection..

The Bureau of Forestry has this year undertaken a thorough study of the forest-fire problem in several different regions. It has placed men in forest districts to study fires while in the process of burning. Instead of waiting until the fires are over and relying for information on local reports, as has been done heretofore, the fires are now being observed by the Bureau's agents and full data will be obtained as to how they were caused, how fast they burn, what conditions favor or hinder them, and just what damage they do to the soil and to tree growth. Each agent of the Bureau has been assigned to a district and is investigating all fires that occur within his territory. For example, one man studies a lumber tract, another a farming district, a third a turpentine orchard, etc.

In connection with this detailed study, the agents will observe the methods of fire protection practised by railroads and other owners of timber lands. The fire warden systems of the States which have forest-fire laws, and the patrol system in use on the federal forest reserves will also be observed closely.

By such methods the Bureau of Forestry hopes to replace with carefully gathered facts the vague general notions that now exist about forest fires. When the problem is solved for any particular region, the Bureau will be ready to recommend methods of fire prevention and control for the private land owner, and to suggest forest-fire legislation for the various States.

The investigation is now in progress in northern Florida and southern Alabama and Georgia under the direction of Ernest A. Sterling. H. J. Tompkins, with a small corps of assistants, has begun the work in Minnesota, Wisconsin, and Michigan. Later in the season a study of forest fires will be made on the Pacific coast.

Aluminium becomes granular and brittle when heated to about 600 deg. Centigrade; at a slightly increased temperature it becomes so soft that it can be easily cut with a knife. Hence all that is needed in order to pulverize it is to heat it to the above-mentioned temperature and pound it in a mortar. With zinc a similar treatment will give the same result.

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Legal Notes.

THE DIFFERENCE BETWEEN A COMBINATION AND AN AGGREGATION.—The case of Fowler vs. the City of New York, which recently came up before the Circuit Court of Appeals (121 Fed. Rep. 747) well illustrates the difference between a patentable combination and an unpatentable aggregation of parts. The patent in issue was that granted to Benjamin F. Carpenter, 1896, for a bi-transit railway system. The patent describes a new plan for handling a large number of passengers who patronize all public vehicles provided for rapid transit in large cities. It was argued that this invention was patentable as a "machine" under the language of Sec. 4886 of the Revised Statutes, which provides that "any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement thereof, . . . may obtain a patent therefor." To this argument the court replied that "if a scheme for handling the traveling public in congested districts can, for patent purposes, be regarded as a machine, it is by no means easy to understand why a new plan for reorganizing the police force, or mobilizing an army, or manipulating the guests at crowded public functions, may not also be aptly described as a machine and patented as such." Even if the patent were granted for a machine, still the court thought that its justification must be found, if at all, in the mechanical means and appliances used to carry out the proposed plan. These were all admittedly old. The feature of the patented system principally relied on to support invention was the arrangement of the tracks, two for express trains and two for local trains, in connection with "island" platforms between the local and express tracks, upon which tracks the trains run in the same direction. By this arrangement a passenger can board a local train, ride upon it until he reaches a station where express trains stop, disembark from the local train, cross the platform, board the express, and ride upon it until he reaches the express station near his destination, where he may, if he likes, again cross the platform and take a local train which will deposit him still nearer the point he desires to reach. The island platforms are provided with partitions and gates which prevent crowding. Of this plan the patentee says: "A conjunctive and co-operative service is thus maintained, and such an arrangement and operation I term 'the bi-transit system.'" While he conceded that island platforms were old, he points out the distinction that they were used on roads having two tracks only, and is of the opinion that their use in conjunction with a four-track road is "an entirely novel feature." Another feature of the system which is apparently regarded as novel in the patent is the introduction of loops and switches, by means of which trains may be shunted over from one track to another.

The court found it impossible to discover any ground for sustaining the patent. Given a four-track road devoted largely to the transportation of passengers, the court thought that any competent railroad engineer would know where to locate the stations, loops, and switches, and he would assuredly arrange for the ingress and egress of passengers, so that they would not be compelled to cross the tracks at grade. To plan these details would undoubtedly require ability of high order, but not inventive genius. The court took judicial notice of the fact that for a century at least it has been customary for passengers living in small towns to take local trains to large cities, remain at the station, and upon the arrival of the express, cross a platform and board the train. Even if before 1895 the trains on either side of island platforms ran in opposite directions, it surely did not involve an exercise of the inventive faculty, in the court's opinion, to run these trains in the same direction. This had never been done before that date because there was no necessity for it. Considering each of the claims separately, the court found that all exhibited a fatal lack of patentable novelty.

THE RIGHT TO USE THE NAME OF A PERSON AS A TRADE MARK.—In 1881 the South Bend Pulp Company was organized to engage in business at South Bend, Ind., in the manufacture and sale of plows. The largest stockholder of the corporation was its president and general manager, T. M. Bissell, who had been for some years engaged in the manufacture of plows, covered by certain patents. These patents he transferred to the company. The plow business of the corporation was separate, and was always conducted under the name of "The Bissell Chilled Plow Works," and all its plows were marked with the name "Bissell," and became known to the trade by that name. In 1891 the making of plows became the corporation's principal business. With the consent of Bissell, the firm name was changed through statutory proceedings to the "Bissell Chilled Plow Works," under which name the business was continued. About the time of the change Bissell sold a part of his stock, retired from the management, and organized a corporation under the name of the T. M. Bissell Plow Company, which engaged in the manufacture and sale of plows in South Bend, making substantially the same plows as the old corporation and marking them with the name Bissell. After a year or so, Bissell died, and the business of the T. M. Bissell Plow Company was discontinued. Subsequently certain persons residing at Eaton Rapids, Mich., purchased a part of the stock, patterns, etc., of the defunct corporation, taking an assignment of the right to use its corporate name, and organized a corporation called the T. M. Bissell Plow Company, to engage in making plows at Eaton Rapids, Mich. Circulars were issued stating the removal of the company from South Bend, and containing pictures of Bissell, and referring to him as "the inventor of chilled plows, once made in South Bend, Ind., and now only made by the T. M. Bissell Plow Company, Eaton Rapids, Mich." Its plows were also marked "T. M. Bissell," and were similar in design and appearance to those of the old corporation. The original Bissell patent for chilling was owned and the procees used by the old corporation, which also held shop rights for the use of the later patents, some of which were afterward owned and used by the Eaton Rapids firm. No one of the name of Bissell or connected with the prior Indiana corporation of the same name had any connection with the Eaton Rapids corporation.

The old corporation sued the new corporation in equity on the score of unfair competition, and sought to restrain the use of the corporate name of Bissell (Bissell Chilled Plow Works vs. T. M. Bissell Plow Company, 121 Fed. Rep. 357). The Circuit Court for the Western District of Michigan held that the second Indiana corporation had no right to use the name of Bissell as it did, either in its corporate name or as a mark of its product as against the complainant, which had acquired the prior right, and that the defendant corporation obtained no right by the assignment; that the action of the defendant in the use made of the name in both respects constituted unfair competition. It was likewise held that the fact that two corporations are located in different communities does not affect the right of one to an injunction restraining the other from unfair competition by adopting a similar corporate name, where they are engaged in the same business and their products are both sold in the same open markets.

AN IMPORTANT TRADE-MARK DECISION.—The case of *ex parte* Faxon, recently decided by the Commissioner of Patents, is important in so far as it limits the registration of trade marks to a single class of goods. The applicant stated that his mark was to be used upon "grocers' supplies," and as a particular description of the goods to which he intended to apply his mark he mentioned "butter, eggs, dried beef in packages, coffee, oatmeal wafers, cracker-meal, butters, saltines, gems, banquets, grahams, sodas, ginger-snaps, teas, and ale."

The practice of the Patent Office upon the question involved has been far from uniform. A former Commissioner held in the case of *ex parte* Silvers (67 O. G. 811) that "registration can be limited by nothing narrower than the actual and lawful use of the mark in the place where the business is located." Assistant Commissioner Greely in the case of *ex parte* Clark-Jewell-Wells Company (83 O. G. 915) stated, when it was urged that division should be made on account of the necessity of office classification, that "one trade mark may be covered by a single registration, but, however desirable it may be, the office is not warranted in requiring that the trade mark be registered for but one class of goods. To require that a trade mark be registered for each class of goods with which it is used—in the present case to require that the trade mark be registered separately for five different classes of goods at an expense of five fees—would be a most onerous requirement."

Registration was permitted to cover all of the enumerated classes of goods.

In 92 O. G. 2508, Acting Commissioner Chamberlain took the other stand, holding that it was not advisable in the case of so-called "department stores" goods, to permit a single certificate to cover many goods. He admitted that it was difficult to lay down any hard-and-fast rule, but he thought it advisable that each certificate should contain a reference to a single class "on general commercial lines."

In the case now decided by Commissioner Allen, it is definitely held that hereafter a single certificate shall cover only a single class of goods. It was thought that Congress could hardly have intended that the scope of registration required under the provisions of section 1 of the Act of March 3, 1881, should be different from the right which, to be invaded by an infringer under section 7 of the same Act, would require this infringer to have applied the mark "to merchandise of substantially the same descriptive purpose as those described in the registration." The Commissioner believed that the class of merchandise referred to in section 1 of the statute was intended as a description of the field in which would be found the particular description of goods to which the particular trade mark has been appropriated. "The language used in section 7 bases identity of application on the only fixed and permanent characteristic available as a test of identity—that is, upon intrinsic properties—and to leave this firm foundation of principle and to base identity of application of the symbol upon the accidental relations of commerce is to substitute an indefinite or temporary external relation for permanent characteristics."

ANOTHER GLOBE-WERNICKE DECISION.—Some time ago we published a digest in these columns of the opinion handed down in the case of the Globe-Wernicke Company against the F. Macey Company, in which it was held that the Globe-Wernicke patent was not infringed and that certain claims were void because they covered no new invention. The Globe-Wernicke Company has been again in court, this time in an action against Brown & Besly. The complainant had for many years made and sold box files under the names of "Leader" and "Eureka" files. The names were printed on the back of each file, and also on an emblem on the first of the index sheets inside. Complainant's name did not appear on the files, but they became thoroughly well known to the trade by the names, make-up, and markings as the product of its factory. The files were widely sold. Subsequently defendant placed on the market files which copied those of complainant in names, emblems, colors, size, and style of type and general make-up so exactly that it would mislead the ordinary consumer, and had nothing thereon to indicate the maker. It was held that such action constituted unfair competition and entitled the complainant to an injunction restraining defendant from the use of such names and emblems, whether or not they constituted trade-marks.

The defendant also made letter files on the order of a customer who sold the same as his own, copied from a sample furnished by the customer, which had been made for him by complainant, and upon which was a patent imprint placed there by complainant because of a patented device of its own used in the files. Defendant omitted the patented device, but through a mistake of employes, and without the knowledge of its officers, the imprint was reproduced on a single order. On appeal (121 Fed. Rep. 90) it was held that such facts would not sustain a suit in equity for an injunction, there being no evidence of an intention to continue the infringement, the damages for past injury, if any, being recoverable at law.

THE ORAL ASSIGNMENT OF PATENT RIGHTS.—The case of Schmitt vs. the Nelson Valve Company (121 Fed. Rep. 93) brought out an interesting state of facts. The complainant while in the employ of the defendant, who was engaged in the business of making valves, invented an improved valve, on which he applied for a patent after a number had been made and sold by defendant. A question having arisen between the parties as to compensating complainant for the invention, a settlement was made, and complainant was given a paper, signed on behalf of defendant, by which it agreed that his salary for the ensuing ten years should be as therein stated, the provision being for an increase from time to time, and complainant orally agreed to assign the patent. He subsequently claimed, contrary to the fact, as found by the court, that it was a further condition of the agreement that defendant would covenant for his employment during such ten years, and refused to assign the patent otherwise and left defendant's service. It was held that by virtue of the contract, defendant became the owner of the patent, and complainant, having refused to perform on his part, could not maintain a suit for its infringement, which he could not have done had he performed.

CONTRACT FOR DIVISION OF DAMAGES FOR INFRINGEMENT.—The trustee for an insolvent corporation had instituted a suit for infringement for a patent. He made an agreement with another person whereby the latter, who had a related suit, agreed to prosecute both at his own expense and to divide the recovery with the trustee. The suit of the trustee was difficult and doubtful, and no substantial recovery probable. Through the energy of the person with whom the trustee contracted, and after nearly twenty years of expensive litigation, a substantial sum was recovered. Upon this agreement the trustee was sued for failure to carry out the contract. Such are the facts in the cases of Worster vs. Trowbridge and Lewis vs. Trowbridge, recently decided in the Circuit Court of Appeals for the Second Circuit (121 Fed. Rep. 667). The Court decided that the contract of the trustee under the circumstance was perfectly legitimate, and that a court of equity would not refuse to enforce it by giving the complaint his share of recovery, which but for his services would not have been received by the estate.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

WEEDING APPARATUS.—B. F. CONKLE and J. T. HALL, Junction City, Ohio. These inventors have devised an improved weeding apparatus for use on railroads. The apparatus may be applied to an ordinary hand-car and it operates over the ties within and outside of the track. It also comprises an extension adapted to remove weeds from the portion of the track lying beyond the ties. This extension has hinged connection with the main frame so that it may properly operate on a sloping bank.

MACHINE FOR PULLING BEETS.—H. G. HOTCHKISS, Lyons, N. Y. This mechanism is adapted to be used with a topping-machine or independently of it, and is so constructed that a series of teeth are pivoted upon a circular rotatable support and so controlled that as the machine advances the forward teeth trail upon the ground and drag the severed beet-tops to the side of the next row. Then the teeth are raised and held elevated until reaching the rear of the machine, where they enter the ground, and in their movement throw the beets out in the row, carrying them forward to the right, leaving the beets between the rows in clean condition, for gathering.

KNOTTER FOR GRAIN-BINDERS.—W. NEWMAN, Alexandria, S. D. The chief defect in ordinary binders is the passing of bundles without tying the knot necessary to bind them. This is due to causes more or less obscure. Generally it is owing to defects in the holding device for the twine and in the knotting-bill caused by faults of construction, wrong principles, wear, variations of thickness of the twine, and other causes. Mr. Newman effectually cures these faults, by providing an improved knotter for tying the twine in a knot after being passed around the bundle.

Electrical Devices.

CONDUCTOR.—G. E. TINKER, New York, N. Y. Comprised in this improvement is a conduit formed of a number of C-shaped brackets, having each at one of its vertical sides an opening therein, these brackets having downwardly-extending lugs, spaced and adapted to engage a non-conducting support. Around the brackets is a non-conducting sheathing, forming a complete tube, such sheathing having an opening therein conforming to the bracket openings, so that the shoe and its arm may be projected through these openings and engaged with a conductor-rail fastened to the brackets.

ELECTRIC LAMP.—G. STEIN, New York, N. Y. This invention relates particularly to improvements in small electric lamps designed for the use of physicians, surgeons, dentists, or the like in making nasal, mouth and other examinations, the object being to provide a lamp so constructed that either a continuous or intermittent light may be had.

Engineering Improvements.

ROTARY PUMP.—M. W. PETERSON, Wright, La. Mr. Peterson's invention is an improvement in that class of rotary engines or pumps in which a rotatable cylinder or piston is arranged within an eccentric chamber and provided with one or more sliding wings or blades against which the motive fluid acts.

COMBINED GOVERNOR AND GAS AND AIR MIXER FOR EXPLOSIVE-ENGINES.—W. F. MEISTER and W. S. PATTIN, Marietta, Ohio. This invention relates to engines of the explosive type, and the improvement consists of a peculiar governor-valve adapted to feed a measured quantity of explosive mixture to a compression-chamber. It is not liable to get out of order or be disarranged by an unskilled attendant.

VALVE-GEAR.—P. S. BOSTWICK, Woodbine, Iowa. The present invention relates to steam-engines, such as described in a former patent granted to Mr. Bostwick. In this case the intention is to provide a gear actuated from the reciprocating cross-head, and arranged to permit minute adjustment of the cut-off mechanism to run the engine as economically as possible.

STEAM-ENGINE.—P. S. BOSTWICK, Woodbine, Iowa. The object in view in this case is the provision of an engine, easily reversed, and arranged to utilize the power developed in the cylinder to the fullest advantage in transmitting the power to the main shaft without producing dead-center positions and dispensing entirely with the use of a pitman and crank on the main shaft.

CONDENSING-LOCOMOTIVE.—D. R. IVETT, Whitebear, Minn. In the present invention the exhaust-steam from the valve-chests is subjected to the action of jets of cold water injected under pressure by pumps supplied with cold water from the tender or other source. The partially-heated water is mechanically forced back to the tender by another set of pumps, while any spent steam after condensation is subjected to compression and forced under pressure back into the steam-space of the boiler. Salient features of the invention may be utilized in stationary and traction engines.

ROTARY-ENGINE.—G. P. BREED, Rockelm, and E. L. HAWN, Olivet, Wis. The invention relates to a rotary engine comprising a casing forming a circular passage equivalent to the engine cylinder, in which are arranged two pistons carried on disks loose on the engine-shaft. When the disk moves in one direction the piston is connected with the shaft by suitable clutches, and when it moves in the other direction the piston is stopped by connection with the casing. In operation steam is admitted between the pistons and tends to force them in opposite directions. The clutches, however, work oppositely so that the one piston acts as an abutment while the other is in motion.

Hardware.

FRAMED PICTURE OR MIRROR-HANGING DEVICE.—E. L. SMITH, Chicago, Ill. The inventor in the present improvement has embodied novel means for attaching a flexible connection to a framed picture or mirror and a novel hook for the other end of the connection, whereby the frame may be conveniently and reliably hung from a fixed molding-strip.

OILER.—G. WILSON, Madelia, Minn. The compact portable oiler in this case is adapted for use in connection with bearings of all kinds, but especially with the parts of bicycles. There is a self-closing valve for the nozzle, opened by the action of the piston in forcing liquid out through the nozzle and which prevents leakage and back action of the liquid. A cylinder is provided in which the piston moves, and the former connects with the nozzle and a reservoir for liquid. There are means for returning the piston, and for supplying liquid to the cylinder while the piston is in its return position.

SASH-BALANCE.—M. BLOME, St. Charles, Mo. This improvement has for its object the provision of a construction easily and quickly applied to a window. It is capable of ready operation in order to facilitate the elevation of a sash, and is equipped with a positive locking device to hold a spring-driven drum under restraint until the time to raise the sash.

Heating Apparatus.

HEAT-REGULATOR.—W. PARKER, Neola, Iowa. This improvement relates to a regulator particularly adapted for use with lamps in incubators or the like; and the object is to provide a regulator very sensitive to changes in temperature, and easily attached to an incubator or other device in which an even temperature is to be maintained.

Mechanical Devices.

SAWING-MACHINE.—J. T. MARSH, Farmer City, Ill. Ripping, cross-cutting, beveling, mitering, etc., are done by this machine. A gage-board is so applied to the movable top of the machine that it is adapted to be set at different angles for different kinds of work. A carrier supports the free ends of long boards or other lumber while being sawed, the carrier and top being so connected that they move together. The carrier is adapted to be extended at distances from the top to adapt it to accommodate lumber of different lengths.

STRAINER-BELT.—C. EDGERTON, Philadelphia, Pa. The present invention is an endless conveyor-belt constructed to act as a continuous strainer to separate liquids from garbage and to resist the compressive strain of the rollers thereupon, in combination with a special construction of roller adapted to receive the chain-links which form a part of the strainer-belt, and is an improvement on two former patents of Mr. Edgerton, for treating garbage.

MEANS FOR MAKING BIFOCAL OPTICAL LENSES.—T. MUNDORFF, New York, N. Y. The object in view in this invention is to enable a one-piece lens having the integral high and lower powers required for near and distant vision to be produced practically, and with the same facility as ordinary one-power lenses, thus enabling opticians to fill prescriptions for bifocal lenses by furnishing articles free from objections urged against the common two-piece lens of this character.

Railway Improvements.

STATION INDICATOR.—J. J. HEBERLE, Olean, N. Y. The invention relates to a station or street indicator, or station register, whereby to display in a conveyance in plain view of all passengers, the name of the next street or station as the case may be, and which may be used in railway stations to announce the leaving time of trains for stations of a fixed route.

RAILWAY RAIL FASTENING.—R. G. MUSGROVE, Jackson, Miss. Means are provided in this invention for fastening railway rails to cross-ties in such a manner as to securely hold the rails in position. The fastening comprises a tie-bar placed under the rails and formed with abutments at the ends adapted to engage the outer sides of the opposite rails. Blocks bearing against the inner sides of the rails hold them firmly against these abutments. The rails are thus afforded a solid support offering a smooth track and doing away with the objectional hammering at joints. With this fastening it is impossible for rails to spread and where used on joints it takes the place of a wire connection to complete the electrical circuit through the tracks.

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Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

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Machine Work of every description. Jobbing and repairing. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 4313.—For machines for grinding sawdust and shavings into an impalpable powder.

Crude oil burners for heating and cooking. Simple, efficient and cheap. Fully guaranteed. C. F. Jenkins Co., 1103 Harvard Street, Washington, D. C.

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The Honoco razor strop made of paper. The perfect strop for a perfect shave. By mail 75 cents. Send for description. Hope Novelty Co., Bristol, R. I.

Inquiry No. 4315.—For an electric machine for waxing and polishing floors.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 4316.—For makers of paper tubes.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 4317.—For makers of brick-pressing machines, also for gasoline engines.

Contract manufacturers of hardware specialties, machinery, stampings, dies, tools, etc. Excellent marketing connections. Edmonds-Metzel Mfg. Co., Chicago.

Inquiry No. 4318.—For a machine for shelling velvet beans.

High class machinery built to order at reasonable rates. Address P. O. Box 607, Baltimore, Md.

Inquiry No. 4319.—For makers of oil tubing for kerosene oil pressure lamps.

WANTED.—To buy patent rights on some useful article that has been patented but not developed. Something that should be a good seller. Address P. O. Box No. 2009, Fort Wayne, Ind.

Inquiry No. 4320.—For makers of a metallic calendar pad stand.

WANTED.—Some novelty to manufacture. Ample capital. Must be article that will meet ready sale throughout the United States. Address Box 52, Titusville, Pa.

Inquiry No. 4321.—For manufacturers of mills or ovens used for making charcoal.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 4322.—For dealers in "Wheatstone's Dial Telegraph Instruments."

G. G. Haldane, Fremantle, Western Australia, importer of American novelties, specialties, imitation jewelry, etc. Manufacturers please send catalogues, quote prices and mail samples.

Inquiry No. 4323.—For dealers in phosphorescent sulphide of calcium.

WANTED.—To lease two 40 to 50 ton six wheel, or eight wheel or ten wheel, or Mogul locomotives. Send general dimensions and report on conditions with proposition. Georgia Iron and Coal Company, Chattanooga, Tenn.

Inquiry No. 4324.—For information as to the new telephone system lately devised.

ELECTRICAL TESTING.—If you wish to know the properties of any electrical instruments, materials or apparatus, the utility of an invention or the practicability of an idea, tests by us might be of great value to you. New York Laboratory, Lamp Testing Bureau, No. 14 Jay Street, New York. 8th Floor.

WANTED.—A manufacturer to make wire carrier and place it on the market in the United States and Canada on a royalty basis. It is an exceptionally all-round good article, and to the manufacturer that means business I will pay for making a number to place on trial to prove it. Address J. G. Cofman, Comptche, Mendocino Co., Cal.

WANTED.—Structural steel engineer who has had at least five years' experience as contracting engineer for steel company, making a specialty of structural steel for fireproof buildings. Must be experienced in designing steel, soliciting orders and closing contracts. Must be a broad gauge man, capable of directing others and managing an office. Good salary and promotion to right man. Adress Engineer, Box 773, New York.

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Notes and Queries.

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References to former articles or answers should give date of paper and page or number of question.
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(9058) G. A. S. asks: A claims that if a gun be fired from the rear of a rapidly-moving train, at a given point, in the opposite direction, and the velocity of the bullet is exactly the same as that of the train, when the train has traveled one mile distant from the point of discharge, the bullet will be one mile from the train, or at point of discharge. B claims that the bullet will be beyond the point of discharge, when the train has traveled the distance of one mile. Who is correct? A. For a full answer to your inquiry regarding a gun discharged from a train in the direction opposite to the motion of the train, see the SCIENTIFIC AMERICAN, Vol. 88, No. 19, Query 8997. A is right.

(9059) F. H. says: 1. Do you publish a SUPPLEMENT containing diagrams, and working drawings of a small transformer to change an alternating current of 110 volts to a direct current of the same or lower voltage? A. You cannot change an alternating to a direct current by a transformer of an ordinary type. A rotary transformer or motor dynamo is required. One part is driven by the current as a motor and drives the other as a generator to produce the direct current required. 2. I was running a small medical induction coil, the other day, with an alternating current of between two and eight volts. I had one of the handles of the secondary coil in my hand, and I happened to touch one of the binding posts of the primary with my other hand, when I received a smart shock. Can you tell me the reason? I did not know that there was any connection between the primary and secondary coils. A. When you touched the binding post of the primary of your coil while you held the end of the secondary in your hand, you made a connection by which the potential of the secondary could force a current through you to the primary. An induction coil frequently sends a spark from the terminal of the secondary into the primary unless the distance is too great to allow it.

(9060) R. C. W. asks: I desire a ready method of marking on glass so as to prevent the sale of stolen electric light globes. There is a method which appears to be simply an application of an electric arc pencil. Will you kindly enlighten me as to its requirements, or give some method suitable? A. The marking upon glass to which you refer as "electric script" is done by a wheel, which is rotated rapidly by a little motor and which engraves upon the glass by friction. There is nothing like an electric arc about it, so far as we are aware. An arc would melt or crack the glass instantly. A sand blast would etch glass very quickly and make any letter, word or design you might wish for identification upon the lamp bulbs.

(9061) J. C. S. says: Please give me the name or names of the chemicals used on glass to take a common photograph. State how I shall spread the fluid over the glass; under what conditions of light. After the photograph has been taken, what is done to the glass to preserve the picture, when the glass is exposed to the sun to print pictures on paper? A. Plates come ready prepared; amateurs do not make them. Negatives are not injured by the sun, in printing. Any amateur photographer would be glad to show you how developing is done. See our SUPPLEMENT catalogue for papers on photography.

(9062) E. A. L. asks: One day last summer I noticed that a thermometer registered about 98, but when placed in the draft of an electric fan it rose about five degrees, registering 103, although it was, or seemed to be much cooler in the draft. Will you please tell me the cause of this? A. On the face of this statement all we can say is that the thermometer rose in the current of air from the fan because the air was hotter which came from the fan than it was in the place where the thermometer had been. Air is not always cool because it feels cool: nor hot because it feels hot. Hot air in motion may cool one by carrying off the perspiration from the surface of the body. In that case the air would feel cooler than it actually is, and we should be deceived by our sensations. A thermometer would not be deceived, but would **give the correct temperature of the air.**

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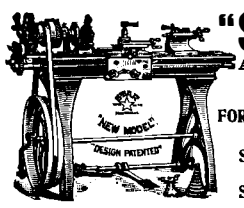

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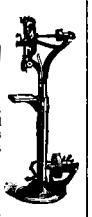

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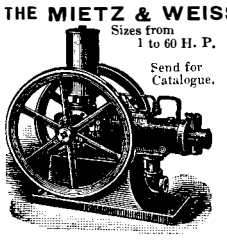

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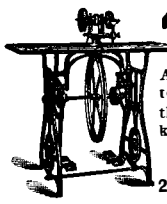

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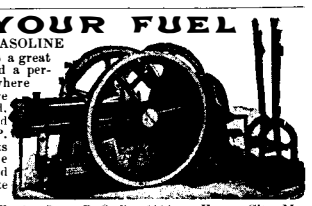

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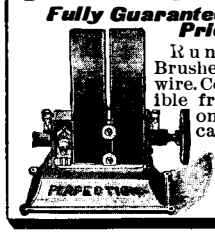

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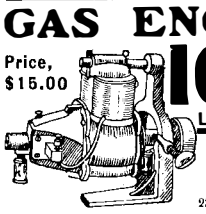

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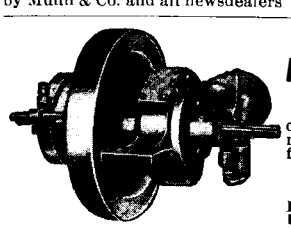

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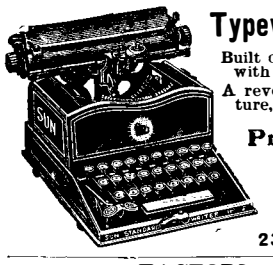

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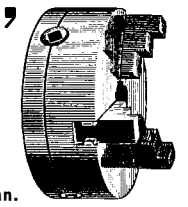

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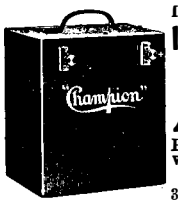

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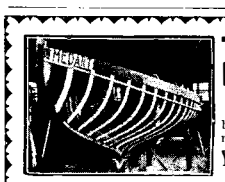

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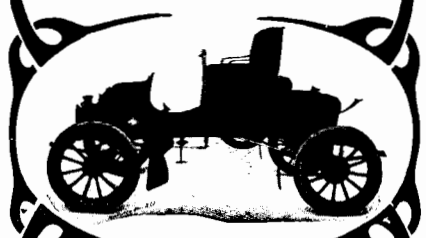

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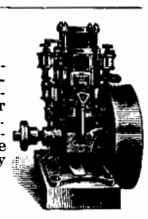

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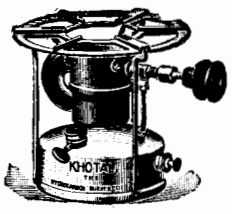

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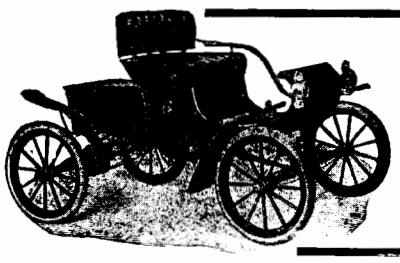

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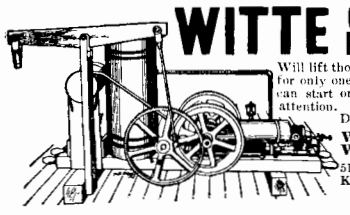

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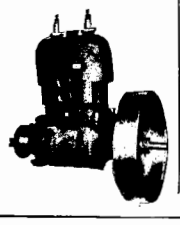

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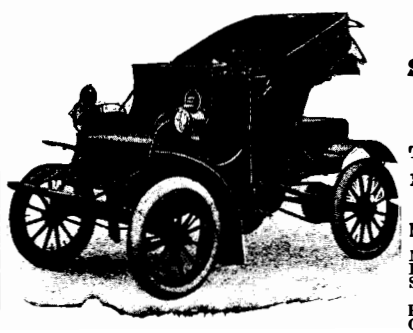

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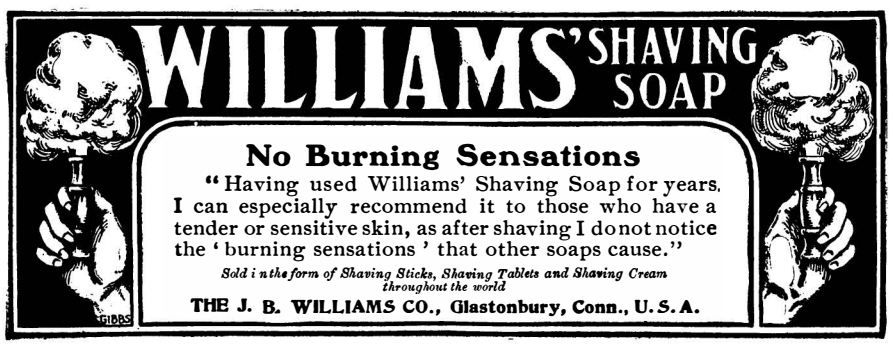
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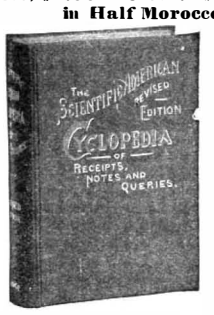

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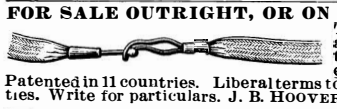

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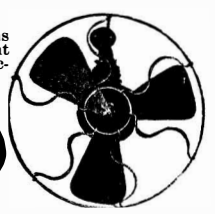

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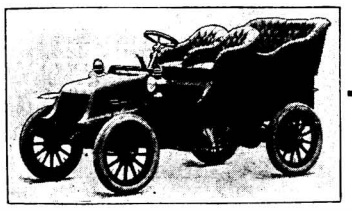

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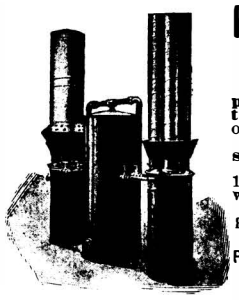

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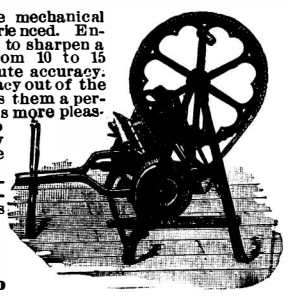

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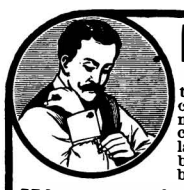

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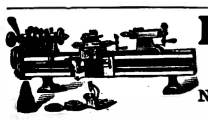

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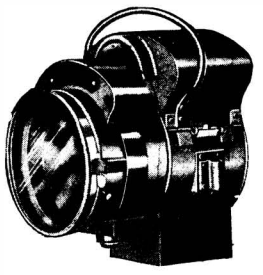

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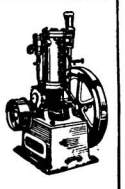

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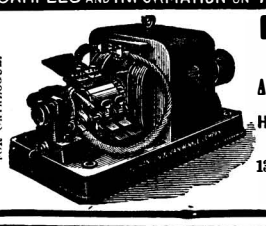

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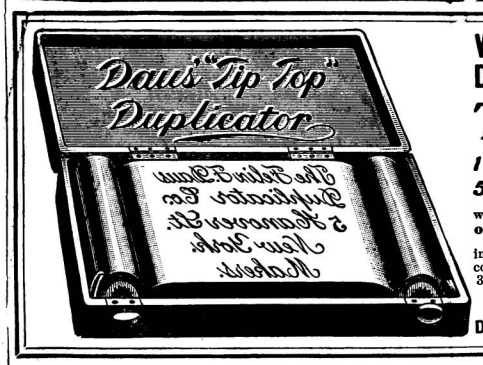

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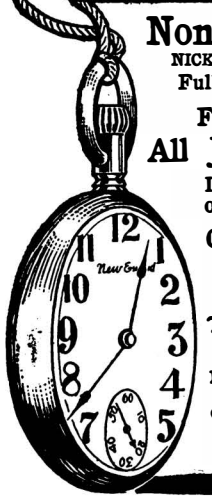

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